

## Abstracts

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### GoPubMed – Knowledge based search

M.R. Alvers\* (*malvers@transinsight.com*)  
*Transinsight GmbH, Dresden, Germany*

*Background:* Does the world really need another search engine? This work will give a clear answer. Search engines allow full text search for words but they all fail miserably when it comes to more complex topics like bio-medical research. Today's search technology is in early infant stage and a lot of important information remains buried in the masses of text [1].

*Objective:* To give insight in the work with the Transinsight Search Engine and quantify the huge potential in terms of Business Value for Science.

*Methods:* Classical searches are successful in helping users to find pointers to information based keywords such as a telephone number on a web page. But they are not successful answering complex questions. We call the process of answering complex questions, which is predominant in the life sciences, knowledge searches. Transinsight's search technologies add a new dimension to traditional search by automatically merging information from documents with knowledge networks. GoPubMed is able to retrieve PubMed abstracts for your search query. Using novel award winning text mining methods for automated recognition of concepts, GoPubMed detects terms from the Gene Ontology (GO) and Medical Subject Headings (MeSH) in the abstracts, displays the subset of the GO and MeSH relevant to the keywords, and allows you to browse the ontologies and display only papers containing specific GO and MeSH terms. Now the GO and MeSH hierarchies can be used to systematically explore the search results. GO and MeSH serve as table of contents in order to structure the over 16 million articles of the MEDLINE data base. Transinsight's core technology is to matching huge amounts of text to huge knowledge-networks fully automated. We deal with 16 Million documents and 120,000 ontology terms.

*Results:* Transinsight developed GoPubMed, a biomedical search engine which uses background knowledge for searches and leads faster to much better search results. Field tests showed, that estimated time savings for knowledge searches are at least 50%: In the life sciences approx. 600,000 scientists are employed. In average they spend 12.4 hours per week searching for relevant Information. Using the technology consequently would help to rise the effectiveness at about 10–15%.

*Conclusion:* The key for enabling search machines to communicate with the searchers is the usage of knowledge. The Transinsight approach is highly suitable to leverage the high potential that lies in faster and more efficient search in lifescience specially for scientific purposes. The shown effect over time savings can help scientists to concentrate on research rather than searching.

Additional to this high potential of searching 50% faster, Transinsights Technology can also be targeted at the common market for text related software and services, which is growing rapidly. In mid-2006 "data and text mining is an expanding field and constitutes a market estimated to be more than US\$12 billion." [2]. Today Transinsight's search technology is tailored for the life sciences.

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\*These authors were submitted as lecturers of the presentation.

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## www.imedo.de – A healthcare virtual community

Ch. Angele<sup>a,b,\*</sup> ([christian.angele@web.de](mailto:christian.angele@web.de)), Ch. Lautner<sup>b,\*</sup>

<sup>a</sup>HHL – Leipzig Graduate School of Management, Leipzig, Germany

<sup>b</sup>imedo GmbH, Stuttgart, Germany

*Background:* imedo.de is an online health community which was launched on April 1<sup>st</sup>, 2007, focusing on peer-to-peer interaction between patients. The community is providing a set of diverse features which are focused on empowering individuals to connect and share health-experiences. Main features are as follows: 1) create and administer local support groups through group functionality 2) find out about treatments which helped for certain conditions (use wisdom / experience of the crowd to find top treatments) 3) set personal health goals and receive motivation from so-called “motivators” 4) ask health-related questions 5) write a health-journal and tell other’s about your current conditions / feelings 6) every user has a comprehensive online health profile where he enters his health interests – other users can connect to this user via profile information. In addition to that, all data is geo-tagged, which enables users to find e.g. diabetics in the same region – this in turn empowers to connect and share experiences.

Many innovative features and tools like SMS-Medication-Intake-Reminders / Doctor’s appointment reminders are provided and tested in order to see if these simple yet potentially powerful tools help to improve patient’s recovery / treatment / well-being in general.

*Objective:* This work is intended to share insights into how users work with provided tools and how interaction helps them to reach their health goals. Moreover, the question of privacy issues in online health communities will be discussed. This issue is very critical since information on the individual’s health status can influence diverse decisions, for example on the labour market.

*Methods:* The work is divided into two parts: one deals with the privacy issues and thus shows criteria a healthcare virtual community has to meet while the other part concentrates more on the user’s behaviour. Therefore, anonymized REAL usage statistics of [www.imedo.de](http://www.imedo.de) will be used as data source for the presentation. Furthermore panel data of imedo.de users will be presented.

*Results:* Data will reveal that users increasingly interact with each other to discuss health issues.

*Conclusion:* Virtual communities will become more and more common in future. The internet is used as a tool for communication between individuals. Long-term data will have to be collected to give more insights in how people use the internet to deal with their personal health challenges.

## The “University Hospital Medical Information Network” at the University of Tokyo: An established tool for research knowledge management

N. Aoki, T. Kiuchi\* (*tak-kiuchi@umin.ac.jp*)  
*UMIN Center, the University of Tokyo Hospital, Tokyo, Japan*

*Background:* UMIN (University Hospital Medical Information Network) is a Japanese network organization fully funded by the Japanese government. Although it was based on its own private communication circuits, originally founded only for 42 Japanese national university hospitals in 1989, it has been made available to other Japanese medical professionals via the Internet since 1994. UMIN services and registered users have greatly increased in number since the introduction of the Internet.

*Objective:* CURRENT STATUS: UMIN provides more than thirty kinds of information services, including those areas of clinical practice, biomedical research, medical education, clinical training, hospital management etc., which have attracted many biomedical professionals and scientists. In 2007, UMIN has more than 270,000 registered users (UMIN ID holders), and more than 3,000,000 web page accesses per month. Among many information services provided by UMIN, ELBIS (Electronic Library of Biomedical Sciences), OASIS (Online Academic Society Information Service), INDICE (Internet Data Center for Clinical and Epidemiological Research), EPOC (Evaluation System of Postgraduate Clinical Training), and DEBUT (Dental Training Evaluation and Tabulation System) are extremely popular.

*Methods:* ELBIS is an Internet-based electronic library, which has a flexible and multifunctional online abstract and paper entry system for biomedical academic meetings and journals. The collected abstracts, papers, and their bibliographic information are automatically added to its electronic library database and are retrievable via the Internet. In fiscal 2006 (April 2006 – March 2007), nearly 500 academic meetings and journals use ELBIS and collected more than 100,000 papers and abstracts. OASIS is a member-only web-hosting service provided for academic societies and research groups. OASIS has several functions: member management system, member mailing list service, and some application software services, such as a document retrieval system and a bulletin board system. OASIS has attracted many Japanese academic societies and has been driving force to register all their members to UMIN, which accounts for the large number of registered UMIN users. INDICE is a kind of application service provider (ASP) for clinical and epidemiological research. The INDICE software packages are customized and provided to clinical research groups.

*Results:* As of March 2007, more than 90 research projects have used INDICE and collected more than 150,000 patient data. EPOC and DEBUT are online evaluation systems of medical and dental clinical residency training, respectively. As of fiscal 2006, approximately two-thirds of medical and one-third of dental clinical trainees used EPOC and DEBUT, respectively.

*Conclusion:* As far as we know, UMIN is one of the largest and most versatile public biomedical academic information services in the world, and is considered as indispensable information infrastructure for the Japanese biomedical community.

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## Supporting e-trials over distributed networks: A tool for capturing randomised control trials (RCT) eligibility criteria using the National Cancer Institute's (NCI) Enterprise Vocabulary Services (EVS)

T.N. Arvanitis<sup>a,\*</sup> (*t.arvanitis@bham.ac.uk*), A. Taweel<sup>b</sup>, L. Zhao<sup>b</sup>, B.C. Delaney<sup>b</sup>, K.A. Peterson<sup>c</sup>, S.M. Speedie<sup>d</sup>, I. Sim<sup>e</sup>, J. Weissman<sup>f</sup>, P. Fontaine<sup>c</sup>, C. Lange<sup>c</sup>, M. Janowicz<sup>c</sup>, J. Stone<sup>c</sup>

<sup>a</sup>*Department of Electronic, Electrical & Computer Engineering, School of Engineering, University of Birmingham, United Kingdom*

<sup>b</sup>*Department of Primary Care and General Practice, School of Medicine, University of Birmingham, United Kingdom*

<sup>c</sup>*Department of Family Medicine and Community Health, University of Minnesota Medical School, University of Minnesota, USA*

<sup>d</sup>*Division of Health Informatics, Department of Laboratory Medicine and Pathology, University of Minnesota Medical School, University of Minnesota, USA*

<sup>e</sup>*Division of General Internal Medicine, University of California San Francisco, USA*

<sup>f</sup>*Department of Computer Science and Engineering, University of Minnesota, USA*

*Background:* In recent years, the role of distributed information and communication technologies (ICT) in the advancement of clinical research is considered essential, as distributed ICT can support the efficient and consistent acquisition, analysis and management of biomedical data [1]. The electronic Primary Care Research Network (ePCRN) is an Internet and grid-based electronic infrastructure research project, funded by the National Institutes of Health (contract no. HHS268N200425212C, NIH Roadmap Programme “Re-Engineering the Clinical Research Enterprise”), which aims to support community-based research trials. The ePCRN e-trials infrastructure supports practice-based research networks (PBRNs) to enroll subjects and pool data for large randomised controlled trials (RCTs) [2]. The ePCRN technology features a secure web portal for online recruitment and consent, real-time computerized randomization, and capability for direct data entry into a centralized database [3].

It has been argued [4] that RCTs offer one of the least biased sources of clinical research evidence. However, the design, management and implementation of such trials are not trivial tasks. In particular, the distributed nature of community-based clinical research makes the identification and recruitment of potential eligible RCT subjects a challenging effort. ePCRN provides the computational and communication infrastructure for supporting eligible identification and recruitment, through a tool that captures trial eligibility criteria of potential participants. The electronic Primary Care Eligibility Criteria Capture (ePCECC) tool presented here is part of the ePCRN technology platform for RCT management (namely the ePCRN workbench) and enables the use of standard terms and common data elements that capture a trial's eligibility criteria. This is achieved through an intuitive user interface that links to the National Cancer Institute's (NCI) Enterprise Vocabulary Services [5], which provide a reference medical terminology vocabulary and standards common data elements.

*Objective:* The main objective of ePCECC is to enable the networked-enabled capturing of clinical trials' eligibility criteria in a standard, efficient and intuitive way for trialists, in order to support the identification and recruitment of potential RCT subjects.

*Methods:* ePCECC provides a dynamic flexible graphical interface to identify clinical concepts, e.g. clinical problems, lab tests etc., and allow searching and importing them directly from NCI EVS on-line servers and databases. Each of these concepts is coded with several coding systems, such as SNOMED, ICD9, etc. Several codes are incorporated for each concept to allow greater searching flexibility and interoperability across Electronic Healthcare Records (EHRs) that are used in order to identify and

recruit potential trial subjects. The interface provides dynamic panes for six generic concepts, namely age, gender, clinical problems, Lab Tests, Vital Signs and Drugs. Specific concepts under each of these six categories can be dynamically added or removed and combined with other concepts, as per the eligibility criteria rules, in several supported logical combinations. Because the tool is directly connected to the EVS system through the appropriate APIs, any changes and additions in the EVS terminology pool are reflected in the eligibility criteria concept model used for specific searches.

*Results:* Once an eligibility criterion is captured, it can be saved and mapped into several standard Internet metadata representation formats, including XML, XPath or SQL. The ePCECC can be used in conjunction with other integrated ePCRN workbench tools to submit generated queries to remote EHR repositories and thus enabling the conduct feasibility studies for potential trials by using the federation of the ePCRN affiliated research networks. Counts of eligibility subjects per clinic or research network that meet the submitted query conditions are returned as a result. The ePCECC has been tested with numerous eligibility criteria of current RCTs.

*Conclusion:* This paper presents a simple and intuitive tool to capture RCT eligibility criteria with a standard codes and clinical concepts using the thesaurus and metathesaurus facilities of the NCI's EVS. It can be used to capture an eligibility criterion as part of a clinical trial protocol and/or can be used to capture general eligibility criteria to conduct feasibility studies using the ePCRN system.

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## Top of your Class (TYC) – Web-based edutainment in medicine

J. Bernauer<sup>a,\*</sup> ([bernauer@hs-ulm.de](mailto:bernauer@hs-ulm.de)), S. Krammer<sup>a</sup>, H. LuuDuc<sup>a</sup>, S. Adam<sup>a</sup>, B. Spellerberg<sup>b</sup>, T. Pietzcker<sup>b</sup>

<sup>a</sup>Ulm University of Applied Sciences, Ulm, Germany

<sup>b</sup>Department of Medical Microbiology and Hygiene, University of Ulm, Ulm, Germany

*Background:* For medical students the acquisition of factual knowledge is often cumbersome and tedious. Edutainment is the act of learning through a medium that both educates and entertains. A challenging edutainment approach is the incorporation of game-based elements into medical e-learning environments.

*Objective:* Goal of the project was the development of a web-based edutainment system in the style of the popular television show "Who wants to be a millionaire". The primary application domain was

medical microbiology. The system was to be used for blended learning concomitantly to ordinary lectures.

*Methods:* The core content of the system is a pool of questions where the student can choose between four answer options, only one of which is correct. With each correct answer the student is rewarded by advancing one level on a scale ranging from high school graduate to department head. While the starting questions are silly and cheerful and can be answered by common knowledge, the level of difficulty rises to more specific microbiological questions and ends with questions that are challenging even for experts in the field. If a question cannot be answered the student can choose between three types of jokers for help. With the aid of the fifty-fifty joker two wrong answer options are suppressed. The audience joker represents the view of a virtual student population. Finally, the expert joker simulates the opinion of a fictive expert. To enhance the learning effect each question is coupled to a short comment explaining the correct answer in a few sentences. The game can be utilized in two different modes. In the regular mode 15 questions with increasing difficulty are randomly selected excluding questions the learner has already been asked before. In the scale mode a fixed sequence of questions is presented. This mode allows for the composition of test questions covering aspects of a particular learning subject.

*Results:* Currently, the system entails about 1000 questions from the fields of bacteriology, virology, parasitology and clinical hygiene. The learning environment is realized by Flash, PHP and XML technologies. Content can be created through a web-based authoring system and is represented in a single XML-file.

*Conclusion:* “Top of your class” has turned out to be an effective edutainment approach in medicine which can be used through the Internet for blended learning.

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## Answering individual patient and health professional information needs in a user driven model of health care

R. Biswas\* ([rakesh7biswas@gmail.com](mailto:rakesh7biswas@gmail.com)), S. Umakanth  
*Department of Medicine, Melaka-Manipal Medical College, Melaka, Malaysia*

*Background:* Average patient data, which occupies most of our present day information bases, is often unable to satisfy individual patient needs. In spite of the medical information base expanding unprecedented at present we still do not have that quality of information to satisfy a given individual patient to an optimal extent.

*Objective:* This is a qualitative proposal with description of present day expert driven medical learning structure and the need for a user driven ambient learning model with appropriate case illustrations.

*Methods:* We need an information base that can seamlessly integrate information needs of all categories of certain individual medical learners namely patients, medical students who are also health professionals with matching solutions offered by other individual medical learners who have already gone through the particular experience the other group needs.

We need to have a medical learning database where patients and medical students/health care givers regularly key in their narrative logs into a suitable web-interfacing device. Presently portable digital assistants are the closest fit although in the near future it is expected to improve into something wearable with a more efficient input arrangement than the PDA stylus keyboard.

*Results:* The individual user (patient, care giver) input is automatically fed to multiple users (nodes) who may synapse with the initial user and other users (via web based matching, email) and finally the resultant learning output shall return to the initial user (by something qualitatively analogous to a back propagation algorithm for example when knowledge is shared with multiple users it keeps getting altered (which perhaps is a hidden layer process among the nodes) and this process may continue to reiterate till there is an optimal solution to the problem.

*Conclusion:* The multidimensional learning proposed here is similar to a learning neural network not in physical-mathematical terms but in terms of qualitative analogy.

### **How do online consumers determine their own health status?**

P. Briggs<sup>a,\*</sup> ([p.briggs@northumbria.ac.uk](mailto:p.briggs@northumbria.ac.uk)), E. Silence<sup>a</sup>, P. Harris<sup>b</sup>

<sup>a</sup>Northumbria University, Newcastle, United Kingdom

<sup>b</sup>Sheffield University, Sheffield, United Kingdom

*Background:* Traditionally health advice has been anchored in face-to-face settings but increasingly patients are using the Internet for their health advice needs. This means that patients are now offered inconsistent advice from a range of sources and must determine which sites to trust and which to reject. To understand how consumers make these choices, the current authors have conducted a series of longitudinal studies with patient groups. Three studies (relating to patients with concerns about the menopause, hypertension and the MMR vaccine) have already been reported [1–3]. This study describes a fourth group – describing those adults who go on line to assess the health risks inherent in their lifestyle or who seek advice to improve health generally.

*Objective:* To understand how consumers make decisions about which websites to trust when in regard to maintaining a healthy lifestyle. To understand how online health consumers interpret health risk data.

*Methods:* Participants were invited to attend a total of four 2-hour sessions at Northumbria University, UK over a one month period and kept a subsequent Internet diary. During all four sessions, participants used the Internet to search for information and advice on their general health, followed by a group discussion with a facilitator. Participants were told to freely surf the web during sessions 1 and 4, in order to secure information about typical search and selection processes. In sessions 2 and 3 they were directed to specific sites, including those offering risk assessments in relation to participants' lifestyle choices.

*Results:* Consistent with our other findings, participants were quick to reject general portals or sites where the information was not readily available and found sites written by like-minded individuals attractive. They showed distinct preferences in their selection or rejection of risk information – often self-selecting those sites that supported a-priori values and beliefs.

*Conclusion:* Based on these findings we present a set of design guidelines for those websites seeking to communicate risk information to participants. We also discuss the extent to which online consumers are capable of reaching reliable assessments of risk in trying to determine their own health status.

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## Middleware-integration into an (EHR) eHealth infrastructure: System design at the example of the ICW toolkit

C. Brunner\* (*christoph.brunner@icw.de*)  
*InterComponentWare AG (ICW AG), Walldorf/Baden, Germany*

*Background:* In many countries, the introduction of electronic healthcare and an all integrated EHR is approaching. This will result in fundamental changes to software applications in healthcare systems. InterComponentWare (ICW) is playing a key role in the development of an eHealth infrastructure for electronic health cards (eHC) and personal health records: One main task is to integrate medical source systems (e.g. physician practice management or pharmacy information systems) with this new infrastructure.

*Objective:* This work aims at the explanation of an all integrated eHealth architecture connecting all distributed systems of single providers at all levels. The ICW Software Development Kit (SDK) is used as an example how to design such a system and how to ease connection and workflow integration in an integrated future eHealth EHR system.

*Methods:* The SDK is used for the simple integration of primary systems to an eHealth (EHR) health cards infrastructure. It comprises an Application Programming Interface (API) which addresses a range of different programming languages using Microsoft COM technology respective Java technology. Primarily, the SDK allows to generate, transfer, and receive data that is exchanged between the primary system and an eHealth infrastructure, such as e-prescriptions, contract data of insured patients or the medication or health history in an EHR.

*Results:* The SDK permits the smooth handling of all mandatory and voluntary applications that are envisioned for the introduction of an eHC, including integration with the LifeSensor® Personal Health Record. The object-oriented API allows primary system providers to access an eHealth infrastructure from their familiar development environment. At the same time, the SDK ensures greater independence: Any changes to interfaces within the eHealth infrastructure generally require no more than an update of the SDK. The interface to the primary systems remains completely unaffected.

*Conclusion:* From our perspective, a consolidated view on a patient's information can be achieved best over a consolidated model which requires the implementation of internationally standardised reference information models. This system can provide high efficiencies providing access to patient's documents that were previously not accessible by medical staff. The initial meta-data repository (describing what document and where to find it) could over time become a repository with more and more normalised patient-centred information – thus providing more quality, higher user acceptance and patient safety. The ICW Software Development Kit (SDK) facilitates the EHR integration by simplifying the programming of interfaces for various services within the IT infrastructure in the healthcare system or for added value applications such as the ICW LifeSensor® Personal Health Record.

## Usability evaluation of cancer websites

R. Butera<sup>a,b,\*</sup> ([rbutera@interfree.it](mailto:rbutera@interfree.it)), M.C. Mazzoleni<sup>a</sup>, V. Balcet<sup>c</sup>, E. Masenga<sup>b</sup>, F. Corbella<sup>c</sup>

<sup>a</sup>IRCCS Fondazione Maugeri, Scientific Institute of Pavia, Pavia, Italy

<sup>b</sup>ProgettareWeb.it, Italy

<sup>c</sup>Fondazione IRCCS Policlinico San Matteo, Radiotherapy Unit, Pavia, Italy

*Background:* The web is one of the emerging and debated tools that provides information and education to patients. Even if the information provided is good and reliable, websites poor usability may limit patients benefits.

*Objective:* To evaluate if and to which extent Italian speaking cancer patients can benefit from cancer websites, focusing on their usability.

*Methods:* Starting from the ISO 9241-11 1998 definition of usability, an “in vitro” assessment was performed. The websites of authoritative Italian Institutions in the oncological field were the object; adult Italian speaking patients were the users; finding information about head and neck cancers was the need; standard PC with popular configuration and no optional plug-in was the context.

A sample of 14 websites was identified, with the implicit assumption that information provided was reliable. Usability evaluation criteria were based on published guidelines [1]: the 21 requisites having the highest relative importance score were considered; they covered technical requirements and usefulness of the content. Assumed that content is useful if meets the user’s need, cancer patients information needs were defined according to a recent review [2]. The following categories were considered: pathology, treatments, prognosis, rehabilitation, coping, interpersonal and body image issues. Two observers marked the websites as compliant or not compliant with the mentioned requisites.

*Results:* Among the 14 websites, 1 required optional plug-in and hence was excluded. The final sample was composed by 8 websites managed by healthcare institutions (HC) and 5 by patients/physicians/research associations (PPRA).

The majority of the technical requisites were satisfied by all of the websites. The most critical aspect was the search functionality: search results were very poorly displayed, with only one exception in which the retrieved information was provided in a very effective way. Secondly, 38% (5/13) of the home pages were not compliant to the WCAG 1.0 Priority 1 level: within the group of non accessible sites, 3 belonged to PPRA.

Websites content coverage was very limited: the less present information was that related to disease progression, topic ranked quite high in the patient’s needs list, while the most frequent covered topics were related to the medical culture. The content of PPRA websites was more comprehensive than HC websites: 3 out of 8 HC websites give no information, or minimal information about a very limited number of topics.

*Conclusion:* The results point out some relevant usability problems, in particular about accessibility for associations websites, and about the provision of useful content for the healthcare institutions websites. Although referring only to a small sample, the situation depicted in this study is comparable with that reported in other national and international studies, where medical websites were non accessible in 60 to 66% of cases [3–5] and failed to meet user information needs in most cases [6–8].

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### Permanent Education in Health Informatics: Evaluation of a pilot Project

L.T. Cavalini\* (*lutricav@vm.uff.br*), H. Kawa, B.D. Gonçalves  
*Epidemiology and Biostatistics Department, Community Health Institute, Fluminense Federal University, Fluminense, Brazil*

*Background:* Health informatics is a strategic tool for health systems management. Production and interchange of health information support health systems mission, playing a role in the organization of health care services, by providing evidences for professional and educational activities [1]. The most relevant morbidity, mortality and management indicators can be elaborated with health information systems databases. These data, because of its volume and complexity, are exclusively provided in Internet-based applications [2]. Thus, it is necessary to provide permanent education in health informatics for health care and health management professionals.

*Objective:* To evaluate a pilot project of permanent education in health informatics.

*Methods:* An Update Course in Health Informatics was developed in a partial on-site/distance education format. The target audience was health management professionals from local (municipalities) health offices, enrolled with public health and primary attention programs. The e-PID website (<http://www.uff.br/e-pid>) was structured to support distance education activities for the course. On-site education was performed at an informatics laboratory, with development of practice activities of data warehousing, processing, estimation and geo-processing of health indicators. At the end of the course, students were asked to fill a course and self-evaluation form with a 1–5 score for 16 questions. Average scores were calculated for the 8 questions about course evaluation.

*Results:* From 35 students admitted, 26 have concluded the Course, and 22 have answered the course evaluation questionnaire. The average scores for each question were as follows: A. Contribution for improving professional skills: 4.3; B. Material resources: 3.6; C. Didactic material: 3.9; D. Organization and functioning of activities: 4.1; E. Pedagogic approach: 4.5; F. Regular attendance and punctuality of the teacher: 4.9; G. Teacher-student relationship: 5.0; Time load: 3.7. The overall average score were 4.2.

*Conclusion:* Despite material problems, typical from public universities in developing countries, and perceived inadequacy of time load, the course was positively evaluated in average. Elaboration and execution of an activity plan, appropriate pedagogic approach and a good teacher-student relationship were features possibly associated to students’ satisfactory evaluation of the course.

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## Open access content in pharmacy-focused journals

K.A. Clauson<sup>a,\*</sup> ([clauson@nova.edu](mailto:clauson@nova.edu)), M. Veronin<sup>b</sup>, N. Khanfar<sup>a</sup>, J.Q. Lou<sup>c</sup>

<sup>a</sup>*Nova Southeastern University – College of Pharmacy, Fort Lauderdale, USA*

<sup>b</sup>*Texas A&M Health Science Center – Irma Lengel College of Pharmacy, Kingsville, USA*

<sup>c</sup>*Nova Southeastern University – College of Osteopathic Medicine/Medical Informatics, Fort Lauderdale, USA*

*Background:* Open access (OA) publishing represents a modern paradigm for access to scientific and medical information. However, awareness and use of OA journals within the field of pharmacy appears to be lacking. Many pharmacists are unaware of the existence and role of OA journals and relatively few pharmacy journals are completely OA or have components which are OA or even freely accessible. This designation is important as organizations such as the National Institutes of Health (NIH) and Wellcome Trust have made open access a priority and since evidence exists that open access articles are more likely to be cited [1,2].

*Objective:* To identify pharmacy-focused journals that are available in open access, freely accessible, hybrid, or traditional formats.

*Methods:* Inclusion criteria were created for the journals to satisfy the definition of pharmacy-focused. Phase I was the preliminary analysis and required inclusion in the 2005 Journal Citation Reports listing of Pharmacy and Pharmacology journals assigned an Impact Factor (IF). Phase II was the full analysis and required that journals were: 1) indexed with a derivation of pharmacy by MeSH term in the journal database of PubMed, 2) located in the Pharmacy Topic of EMBASE, or 3) included in a derivation of pharmacy in the Items List of International Pharmaceutical Abstracts (IPA).

The format of each journal was categorized as open access (including OA, OA hybrid – date restrictions, and OA hybrid – content restrictions), freely accessible (including freely accessible/non-OA, freely accessible/non-OA – date restrictions, and freely accessible/non-OA – content restrictions) or traditional. To be designated as open access, the journal content must have been completely and immediately accessible and must not have required transfer of copyright [3]. Descriptive and inferential statistics were used to analyze results. Data from Impact Factor were transformed from continuous to discrete to allow further testing and correlation analysis.

*Results:* As a research-in-progress study, preliminary results are available. For Phase I, the final list of pharmacy-focused journals was comprised of 189 discrete journals. Of those 189 journals, 158 were classified as traditional, nine as freely accessible/non-OA, nine as freely accessible/non-OA – content restrictions, seven as freely accessible/non-OA – date restrictions, four as OA hybrid – date restrictions, two as open access, and zero as OA hybrid – content restrictions. For Phase II, the final list of pharmacy-focused journals was: PubMed (460), EMBASE (185), and IPA (471). It is expected that a higher percentage of journals will be open access and freely available in Phase II as newer (open access) journals are less likely to be tracked by Thomson ISI and may be underrepresented on that list.

**Conclusion:** The vast majority of pharmacy-focused journals examined thus far are traditional in format. A very small number of pharmacy-focused journals are currently open access and a relatively small percentage is freely accessible. Improved access to these journals and adoption of some form of the open access model would be beneficial for healthcare professionals.

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## Evaluating cancer pain websites

C. Colombo<sup>a,\*</sup> ([ccolombo@marionegri.it](mailto:ccolombo@marionegri.it)), P. Mosconi<sup>a</sup>, C. Bassi<sup>b</sup>, F. Bernardi<sup>c</sup>, M. Bosisio<sup>d</sup>, P. Copelli<sup>e</sup>, C. Crotti<sup>f</sup>, A. Erroi<sup>g</sup>, M. Magri<sup>h</sup>, C. Pandolfini<sup>a</sup>, V. Pistotti<sup>a</sup>, E. Santoro<sup>a</sup>, E. Zucchetti<sup>i</sup>

<sup>a</sup>*Istituto Mario Negri Milano, Milan, Italy*

<sup>b</sup>*Centro per la valutazione della efficacia della assistenza sanitaria Modena, Modena, Italy*

<sup>c</sup>*Tribunale dei diritti del malato Treviso, Italy*

<sup>d</sup>*Istituto Nazionale dei Tumori Milano, Milan, Italy*

<sup>e</sup>*Arcispedale Santa Maria Nuova Reggio Emilia, Italy*

<sup>f</sup>*Istituto Europeo di Oncologia Milano, Milan, Italy*

<sup>g</sup>*Consumers' Representative, Italy*

<sup>h</sup>*Collegio IPASVI Lodi, Italy*

<sup>i</sup>*Fondazione Floriani Milano, Milan, Italy*

**Background:** Despite the existence of guidelines for cancer pain management and the availability of effective treatments for at least 70% of cases, under treatment is well documented in Italy as a result of an incorrect use of opioids for barriers related to healthcare provider, patient, family and society.

**Objective:** To facilitate the use of selected web resources and arise critical appraisal skill in reading internet information about cancer pain.

**Methods:** In the context of a wide project coordinated by the Mario Negri Institute [1], websites about cancer pain have been selected and divided into categories in the catalogue Paincare (<http://www.paincare.it>). These websites have been evaluated [2] among the project Internet as an instrument to search for information about cancer pain, developed with the support of Lu.V.I. foundation. A multidisciplinary team developed a questionnaire into two forms: one for patients associations', medical societies and institutional websites, the other for information websites. Both are composed by questions with three answer options, and by linear scales from 0 to 10 about information completeness, scientific value, usefulness, intelligibility, transparency and usability. Reviewers independently assess 78 associations' and 55 information websites using the online forms; each site was evaluated by two reviewers.

**Results:** Preliminary results are available: websites are different as regard structure, quality of contents, targets and transparency. According to the mean value expressed by reviewers about items such as scientific value, usefulness, transparency, information websites seems to be better than associations' ones. On the other hand, regarding items about websites' structure, such as the identification of the authors and the provider, associations websites got higher scores.

*Conclusion:* Internet information on cancer pain is heterogeneous, so it was difficult to set up and apply the questionnaire in a uniform way. As far as concern the Paincare, we will remove websites with low profile. Regarding the questionnaire, some items resulted too specific and redundant, so a second version useful to evaluate health related websites, not only those dealing with pain, will be ready soon.

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## Advanced level of work with a client in the connection with IS

A. Daniel\* (*ales.daniel@mnul.cz*), M. Zeman, J. Pejchal  
*Masaryk Hospital, Usti nad Labem, Czech Republic*

*Background:* In the modern health care institution the customer – patient care is provided within the rules of customer-oriented organization. Satisfaction of a customer is a basic reason of existence of every organization and a hospital is not an exception. There are many ways how to contribute to this attitude of a health care organization at the time of information society. One of them is to use specialized information systems and technologies.

*Objective:* The project objective is to improve work with a customer with the help of booking and call system for clients in the hospital environment.

*Methods:* Implementing of booking and call system that is able to communicate with a hospital information system. Thanks to the system flexibility there have been implemented several ways how to realize the whole process of booking and calling. A new web interface has been created so the patients can book themselves from their homes including the communication tools such as e-mails or sms functions.

*Results:* Implementing of a pilot version of the system brought improvement not only for on-the-spot customers but also for the customers using organization internet web pages from home. The most important contributions are following: customers are more relaxed during waiting time, booking is more transparent, there exist possibility for a patient to choose more suitable time, the time between consequent examinations got shorter.

*Conclusion:* Implementing of a complex information system that connects several, originally separated, functions has brought not only increased number of extra services for customers but it also has increased the quality of these services. More transparent booking system, possibility to choose more suitable time and more relaxed customers are the main factors of quality increase.

## Biomedical data mining in a hospital information system

P. Daumke<sup>a,\*</sup> (*philipp.daumke@klinikum.uni-freiburg.de*), K. Markó<sup>a</sup>, J. Paetzold<sup>a</sup>, M. Müller<sup>b</sup>

<sup>a</sup>*Department of Medical Informatics, University Medical Center Freiburg, Germany*

<sup>b</sup>*Department of Dermatology, University Medical Center Freiburg, Germany*

*Background:* Doctors in German hospitals are dissatisfied with the extent and the access to patient-centered and other scientific information. Meta-search solutions where users can easily browse through different data sources using a single intuitive interface are a high demand. We describe how the promising technology of biomedical data mining can improve the use of hospital information systems: a large set of unstructured, narrative clinical data from a dermatological university hospital including discharge letters and other dermatological reports were processed through the morpho-semantic text retrieval engine MorphoSaurus [1] and integrated with other clinical data using a web-based interface. The system was brought into daily clinical routine.

*Objective:* The access to the medical information contained in current Hospital Information Systems (HIS) is mostly horizontal, i.e. patient-centered: by opening an electronic health record the doctor gets all information about a specific person. For the clinician, non-structured, very heterogeneous information like discharge letters, anamnesis, reports of particular investigations and other narrative data are of high relevance for patient care: the more information the HIS stores, the more interesting are its vertical, i.e. inter-patient interdependencies.

Some questions the doctor could pose:

- “What patients did I treat that had the same disease?”
- “What were the outcomes/adverse effects of that treatment?”
- “Did I have patients with disease X and symptoms Y?”

Although several promising technologies like the Clinical Document Architecture and medical terminologies have been developed in order to standardize and structure clinical information, there is still a gap between this clinical need and today's practice.

*Methods:* Almost 30,000 clinical documents were extracted from the HIS database. These were mainly discharge letters, but also surgical reports, immuno-dermatological findings and different other narrative reports of clinical results. Using the medical text retrieval engine MorphoSaurus, all data were made available to the clinicians in a Google-like search interface. As the system should show the clinical impact of biomedical datamining, an evaluation engine was implemented. Users were intermittently encouraged to assess their benefit of the system and its further potential for their work.

*Results:* The user evaluation showed a very high user acceptance. It contained 20 user data sets (15 physicians, 3 students, 2 information specialists). 82% stated that the system could enhance their clinical performance. Almost 89% thought that this kind of clinical data mining have a very positive impact on their scientific work. The system seems to meet the clinicians' requirements for a vertical view on the electronic patient records.

*Conclusion:* Our experiences show, that there is an emerging need for integration of biomedical data and text mining techniques in Hospital Information Systems for clinical, scientific, educational and economic reasons.

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## **The value of medical terminology for clinical workflows**

D. Diekmann\* ([d.diekmann@id-berlin.de](mailto:d.diekmann@id-berlin.de))

*ID Gesellschaft für Information und Dokumentation im Gesundheitswesen mbH, Berlin, Germany*

*Background:* Medical information is communicated in a rather large volume and in a variety of formal ways. The views or arrangements of what should be discovered or suggested in analysis often vary between doctors, clinics, countries, and from year to year. Unique terms from individual languages are found embedded and stamped within their language area. From this intermingling foundation, health professionals naturally use their local language and therefore are subject to use their local characteristics. Thus, if one liked to work with the natural health professional's language then one must "teach" the computer these linguistic conglomerates.

*Objective:* Outline the function and architecture of an efficient medical terminology system at the example of the ID System and give an estimation of the potential for the effectiveness of clinical workflows and clinical documentation purposes.

*Methods:* The medical information gathered over a period of time and between countries can exchange classifications that contain the descriptions of diagnostic, therapeutic procedures, and methods that were created in the past decades. This classification is in no doubt very useful, however, it can also create new problems. Thus, several classifications are used in similar institutions and the classifications which are mainly applied to those of the German-speaking areas like ICD-9, ICD-10, OPS-301, ICPM, CHOP, MEL, KTL, ZLE, TNM, and AO, are regarded as content that are by no means complementary or congruent. The solution to the problem of an automated communication system can also only lie within the understanding of the technical colloquial language.

*Results:* Based on the drafts of the medical informatics, Professor Wingert, Berlin enterprise ID developed, within the past years, the medical-semantic net ID MACS® which is a system built to process the special medical language. ID MACS® is a medical frame of reference where any initial parameter standardizes and illustrates contents from classifications, nomenclatures, reimbursement systems, books, guidelines, clinical paths, and conclusions. In addition, the associations can be demonstrated in rough clusters or with a high detailed degree. Not only is the optimization of the medical process supported through application fields like this, but the evaluations until now cannot be provided to allow the analyses concerning the health-economic parameters. An important purpose in the set of applications is the standardized terminology of ID MACS® which if used by the general administrative parameter (including the reimbursement in the DRG-system), it is a "by-product" of purely clinical documentation.

*Conclusion:* The multilingual beginning of the medical-semantic net is a newly growing interest in Europe. The application of such nets can be accepted for operational areas, like the production of the clinical paths of treatment, on the basis of generally accepted yet specific knowledge. Another example would be the development of publications provided through the internet that concern the patient's data or the conversion of general meanings put into different languages.

## **Clinical outcomes resulting from telemedicine: A systematic review**

P. Di Giacomo\* ([paola.digiacom@uniroma1.it](mailto:paola.digiacom@uniroma1.it)), L. Bocchi

*University of Florence, Center for Biomedical Research, Florence, Italy*

*Background:* The use of telemedicine is growing, but its efficacy for achieving comparable or improved clinical outcomes has not been established in many medical specialties. The objective of this systematic

review was to evaluate the efficacy of telemedicine interventions for health outcomes in two classes of application: home-based and office/hospital-based.

*Methods:* Data sources for the study included reports of studies from the MEDLINE, EMBASE, CINAHL, and HealthSTAR databases; searching of bibliographies of review and other articles; and consultation of printed resources as well as investigators in the field. We included studies that were relevant to at least one of the two classes of telemedicine and addressed the assessment of efficacy for clinical outcomes with data of reported results.

We excluded studies where the service did not historically require face-to-face encounters (e.g., radiology or pathology diagnosis). All included articles were abstracted and graded for quality and direction of the evidence.

*Results:* A total of 25 articles met inclusion criteria and were assessed. The strongest evidence for the efficacy of telemedicine in clinical outcomes comes from home-based telemedicine in the areas of chronic disease management, hypertension, and AIDS. The value of home glucose monitoring in diabetes mellitus is conflicting.

There is also reasonable evidence that telemedicine is comparable to face-to-face care in emergency medicine and is beneficial in surgical and neonatal intensive care units as well as patient transfer in neurosurgery.

*Conclusion:* Despite the widespread use of telemedicine in virtually all major areas of health care, evidence concerning the benefits of its use exists in only a small number of them. Further randomized controlled trials must be done to determine where its use is most effective.

### **Cost effectiveness and clinical effectiveness of (tele)monitoring of heart failure patients: A multilayer simulation model**

Ch. Elsner<sup>a,\*</sup> ([christian.elsner@hhl.de](mailto:christian.elsner@hhl.de)), G. Hindricks<sup>b</sup>, D. Häckl<sup>a</sup>, H. Wiesmeth<sup>a</sup>

<sup>a</sup>Leipzig Graduate School of Management (HHL), Leipzig, Germany

<sup>b</sup>Heart Center Leipzig at the University of Leipzig, Leipzig, Germany

*Background:* Literature describes chronic heart failure as sometimes even more malignant than cancer [1]. As a very common diagnosis with poor prognosis patients affected are major consumers of healthcare resources. Literature describes different methods to monitor patient populations by different means of telemetric follow-up. The effectiveness of multidisciplinary non-pharmacological approaches for improving outcomes in patients with chronic heart failure has been well established in over 30 randomised trials. The values for cost savings and different population effects vary quite high [2] depending on the chosen population and the cost- / healthcare system.

*Objective:* Objective of this paper was to build a multilayer simulation model allowing the analysis of certain methodologies of telemonitoring including the selection of certain subpopulations and cost-systems. Target values were achieved COST/QALY values and the monthly technology value in terms of certain cost/effectiveness thresholds.

*Methods:* A Meta-model simulation was built based on Treeage Data Software and Microsoft Excel. For the simulation data different literature data on different cost, epidemiology and process-workflow data was selected and normalized for the simulation. The simulation was then tested and validated according to international standards with different experts and testing scenarios [3]. The simulation is able to generate results in a min, mid and max-case scenario. The modeling of the selected population

was done over 12 selected population parameters like NYHA-Distribution, AF-probability and other parameters.

*Results:* The simulation is able to estimate the monthly technology values and generated QALYs for different populations for telemonitoring scenarios. We simulated these for the Technology of Pacemaker/ICD-based Home Monitoring for a TEN-HMS and a MADIT II population. The mid-case and preliminary monthly value for the TEN-HMS population was at 348 Euro at a Cost per QALY of 24,000 Euro and at 254.50 Euro for the MADIT II population at the same cost per QALY. The MADIT II monthly technology value included a value of 60 Euro for Process-related savings in ICD-follow-up [4]. The generated QALYs for 1000 Patients p.a. level at around 97 for the TEN-HMS population and at 36 for the MADIT II population.

*Conclusion:* As other studies suggest, the value of CHF-related telemonitoring services is quite high and quite valuable for the patient. Our study adds distinct monthly technology values for selected population. The developed model allows easy simulation of Cost per QALY and monthly value estimations for other populations and cost systems. The modeling is easy over selected population and cost system parameters.

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## An economic model for the use of SELENASE® in severe sepsis: Cost effects for hospitals and COST/QALY of the treatment

M. Egbring<sup>a</sup> ([marco.egbring@usz.ch](mailto:marco.egbring@usz.ch)), Ch. Elsner<sup>b</sup>

<sup>a</sup>Department for Pharmacology, University of Zürich, Switzerland

<sup>b</sup>Leipzig Graduate School of Management, Leipzig, Germany

*Background:* The treatment of severe sepsis is a multidimensional approach in hospitals. Still the mortality of sepsis is quite high with up to 50% in populations with an apache score over 70 [1] and cost of most standard treatments is quite high with up to 7000 Euro for a 96-hour treatment e.g. with Xigris® [2]. From the SIC Study [1] it is known, that this mortality can be reduced significantly. Nevertheless no cost per QALY and additional treatment cost analysis for the use of SELENASE® p.i. was performed up to date.

*Objective:* Objective of this work was to setup an internet-based model for a rough COST/QALY and additional treatment cost analysis for a sepsis therapy in patients with severe sepsis (apache score over 70).

*Methods:* For the calculation a simple Excel-based and Treeage / Markov-Chain based simulation model was used and published as interactive model over ASP pages in the internet. The model used data

from the SIC study and additional cost data obtained from the INEK database and the work of Angus et al. [2] and Bone et al. [3].

**Results:** The Model revealed an interactive calculation model. Mean cost data for the treatment of severe sepsis patients (only medication cost, Therapy with Xigris depending on number of organs in failure according to guidelines) was at 3103.09 Euro per Patient without SELENASE® and at 3108.99 Euro per Patient with SELENASE®. Projected to the 28-day mortality of the SIC Study [1] this results in a COST/QALY of 674.31 Euro per saved quality-adjusted lifeyear. Projected to the DRG-system and weighted over the different mortalities of the two populations the treatment is cost neutral and in some cases – depending on the simulation parameters – cost positive.

**Conclusion:** The treatment with SELENASE® in severe sepsis patients a nearly cost-neutral measurement for hospitals. Gross economically spoken the treatment is highly cost effective and near a dominant treatment option and can be highly recommended not only in terms of mortality reduction, but also in terms of cost-effectiveness.

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## Comparing paper-based vs. Internet/handheld-based clinical trial coordination in a study on hernia inguinalis: How good is cost/benefit ratio?

M. Egbring<sup>a,\*</sup> ([marco.egbring@usz.ch](mailto:marco.egbring@usz.ch)), A. Wolf<sup>b</sup>, A. Merz<sup>b</sup>

<sup>a</sup>Department for Clinical Pharmacology, Zürich, Switzerland

<sup>b</sup>Spital Menziken, Kanton Aargau, Switzerland

**Background:** For the conduction of clinical trials vast amounts of clinical data need to be collected, proved, organized and analysed. Many clinical trials are still conducted paper-based with high needs for study monitors and extra queries for logical mistake correction and data consistency approval. For this reason Remote-Data-Entry (RDE) via the Internet on a centralized Database is used and is seen as the most promising future technology. This architecture in combination with handheld mobile devices and a Handheld-Client Software is ideal for data entry from distributed locations that have little or no computer infrastructure. Many Investigators still feel hindered to introduce the new technologies yet, as far as no exact data on benefits and cost/benefit ratios exists.

**Objective:** The aim of this work was to get data on these questions by conducting a clinical trial both ways paper- and internet-based and compare outcomes of the two arms on different aspects.

**Methods:** For a retrospective Clinical Trial on the Outcome of different surgical treatments on hernia inguinalis a standardized Query designed from the Swiss Society for Surgery was implemented at a Hospital in Switzerland (Spital Menziken, Kanton Aargau). The implementation was both paper-based and electronically. For the paper-based approach simple multiple-choice papersheets were filled for each patient and sent via normal snail-mail. These sheets were then double-entry typed into an access-database from where they could be further processed. For the electronic way the World Wide Web

(WWW) was chosen as infrastructure for the system. This allows very easy access via an Internet-PC for all participants and the investigator. The system itself is based on Handspring Visor Devices combined with a Internet-Docking-Cradle and a Client-Software which synchronizes Handheld-Database and central Server-Database over the Internet. The local PC is a normal Windows machine, the Server is a Linux-Server with a MySQL Database. All data is calculated on the Server and Results can be viewed by the Investigator realtime via dynamically generated HTML-Pages on every normal Webbrowser. The Forms for the datainput are interactively checked on the Visordevice. The system can handle complex datainput and also allows to record signatures on the Handhelds. For the Investigator the System can generate graphical diagrams from the raw data in real-time on every Internet-PC with a Web browser.

*Results:* Overall the electronic system showed to perform with a highly significant better time factor. While the transfer-time from Patient-Chart to Form was in both cases at an average of 5.2 days (Paper) and 4.4 days (Electronic), the time needed for the transfer was significant different: Paper-Transfer needed an average of 12.4 days and electronic forms were synchronized at an average time of 1.7 days. The electronic version could be viewed in “real-time” after 6.1 (avg) days, while Paper-data needed 17.6 (avg) days and had to be exported from Microsoft Access to be analyzed and graphical displayed. Data consistency was significantly higher in the electronic forms. While per Paper-Form 0.176 additional queries were necessary in average, electronic forms needed only 0.023 additional queries.

*Conclusion:* The major benefits of a system like the described lie in the little need of infrastructure, the central and real-time calculation of the medical data input and the easy check of input over interactive forms. The developed platform allows easy and secure exchange and processing of studydata over the internet. Benefit against Paper-based systems are for our trial significant in matters of time and data consistency. Benefit against simple PC-based systems is the possibility of a bedside-data-input, which leads to faster data-capture in our opinion and allows to treat data as sourcedata with electronic signature in sense of FDA 21 CFR Part 11 Regulations. Overall we had good experience with our system. If a Site has Internet-Access, Investments for the system are very low by average costs of 200 Euro Hardware and 100 Euro Training Costs per User. We think that a system desgined like ours will reduce costs significantly in bigger trials, where costs per additional query rank at about 100 Euro.

### **Open source or commercial products for electronic data capture in clinical trials? A scorecard comparison**

M. Egbring<sup>a,\*</sup> ([marco.egbring@usz.ch](mailto:marco.egbring@usz.ch)), H. Kottkamp<sup>b</sup>, T. Berger<sup>c</sup>

<sup>a</sup>University of Zürich, Department for Clinical Pharmacology, Zürich, Switzerland

<sup>b</sup>Hirslanden Gruppe, Heartcenter Zürich, Zürich, Switzerland

<sup>c</sup>Berger Software Inc.

*Background:* In Multicentre Cardiology Studies the collection, organization and statistical analysis of study data requires a sophisticated information support system. An ideal system should be easy accessible and should provide high security. For this reason Remote-Data-Entry is seen as the most promising technology. This way of (Inter)net-based clinical data management is ideal for data entry from distributed locations that have little or no computer infrastructure.

*Objective:* The authors have experience with some OPEN-Source engineered products set up in a LAMP and/or PHP and ODBC/Office environment, have used the PhoSCo Platform and have used professional tools for the management of clinical trials. With the small-sized and flexible Open-Source Software-Packages clinical trials can be managed to an certain extent.

*Results:* With Open-Source Packages like PhoSCo even huge trials can be managed at low cost for software licenses. Choosing a professional environment makes trial control and management more convenient but also much more costly and not in every case more flexible. The objective of this paper was to develop a Scorecard for the evaluation of software and dimension of projects to determine which use of components is feasible. The Scorecard is a three page questionnaire with chapters of 1. Needs in Project-Management and Remote-Work Components at Studysites, 2. Determination of Study-Size and Volume of Data, 3. Determination of needed Software-Components, 4. Determination IT-Knowledge for the Project, 5. Special Needs in Hardware and Security. A Scorecard System allows to determine a Product Recommendation.

*Conclusion:* The questionnaire may be useful for other groups e.g. for determination which environment may be feasible for their single study approach, but also for project planning and further development of the questionnaire.

### **What expertise should web services provide for electronic prescribing software in a resident care setting?**

M. Egbring\* (*marco.egbring@usz.ch*), G. Kullak-Ublick  
*Department for Clinical Pharmacology, Zürich, Switzerland*

*Background:* Electronic prescribing has arisen as a valuable tool in the hospital setting to improve the process of prescribing. The use of electronic prescribing can dramatically reduce medication errors [1]. The rate of error reduction varies with the design and functionality of the system [2]. The amount of additional information supplied in the process of prescribing has to be customized. To maximize the potential of electronic prescribing for the resident doctor the requirements have to be first explored and then considered in the development process [3]. We surveyed physicians to collect information about their requirements alongside already available tools to adapt dosing in renal insufficiency or interaction checks.

*Methods:* Based on the list of resident doctors, who report adverse events to our regional pharmacovigilance center or requested conciliar advice on complex medical therapies, we conducted a survey of 134 randomly chosen physicians in October 2006. The sample received a mailed survey with a postage-paid return envelope. The raw response rate for this probability sample was 31%.

*Results:* The available expert opinion provided by the clinical pharmacology in the fields of cholestasis, liver injury, porphyria, inflammatory bowel disease and complex medical therapies has been rated very valuable information in the treatment of specific patients. Most residents doctors additionally emphasised the need of individualized information in the field of polypharmacy, pharmacogenetic testing and therapeutic drug monitoring in particular patients.

*Conclusion:* Our data shows a demand of the availability of specific information in the medical treatment of patients. The information has to already incorporate patient specific parameters or special considerations of the existing treatment in order to be of value. Only relevant information in the patient setting should be displayed to avoid a feeling of pseudo safeness of the physician in the medical therapy. Electronic prescribing assisted by knowledge based systems via web services may improve the quality of prescribing drugs, if the information displayed is patient specific and has an relevant impact on the treatment.

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## Generation We-Dot-Com 2.0.: How young people use the Internet for health information

J.F. García-Gutiérrez\*, J. Jiménez-Pernett\* (*jaime.jimenez.easp@juntadeandalucia.es*), M.C. Salcedo-Sánchez, M. Pérez, A. Olry de Labry  
*Andalusian School of Public Health, Campus Universitario de Cartuja, Granada, Spain*

*Background:* Young people are spending more and more time online but, is that time spent mostly on fun & games, or are they also turning to the Internet for information on their own health and well-being? What types of issues are they researching online, and how do they go about finding the health information they need? Do they trust what they learn?

*Objective:* To explore Spanish adolescents' perceptions and experiences of using the Internet to find information about health, in the context of the other health information sources that are available to them.

*Methods:* As this work was necessarily descriptive and exploratory, a self-administered written survey ( $n = 800$ ; 46% male / 54% female) and a series of 10 focus groups (including 8 participants each) were convened with adolescents (aged 15–19 years) attending at a representative and randomly selected sample of 10 secondary schools in Granada city (Spain).

*Results:* Among all 15–19 year-olds:

- Nine out of ten (90%) have gone online.
- Three out of four (82%) have Internet access from their home.
- One in four (22%) has gotten “a lot” of health information from the Internet.
- The most significant sources of health information continue to be such traditional sources as parents & friends (61%) or doctors & nurses (56%), followed by Internet (52%) and newspapers & television (43%).

However, few young people (10%) say they would trust health information from the Internet. Among the 90% of all 15–19 year-olds who have ever gone online (known throughout as “online youth”):

- Six out of ten (57%) go online at least once a day.
- Nearly all (96%) go online at least a few times a week.
- Three out of four (70%) have used the Internet to get health information, which is rather close to the proportion that have ever played games or downloaded music online (87%), tracked materials for school homework (85%) or participated in a chat room (80%). Less than one in ten have ever gone online to buy something (7%) or participated in eLearning courses (5%)

Among the 70% of all 15–19 year-olds who have used the Internet to find health information (known throughout as “online health seekers”):

- Nearly all (98%) use search engines (mainly Google) as the primary tool for finding health information on the web. Other popular methods include directly seeking out specific sites they may have heard of elsewhere (50%) or by coming across information through links or banner ads (45%).

- Nine out of ten (96 %) have searched information for themselves and seven out of ten (70%) also for a family member or a friend.
- Three out of four (75%) seek health information online at least once a month. (25% once a week)
- Half (50%) of all online health seekers have looked up information about each of the following subjects: body image & beauty, physical exercise & body maintenance, piercing & tattoos, pregnancy & birth control, healthy eating & nutrition and sexuality. About one in three has researched problems with drugs or alcohol (36%), AIDS& other STDs (34%), skin care (33%) or eating disorders (30%). Only one in ten have searched information about mental illness, depression or suicide (12%).

*Conclusion:* In a world where three out of four online youth have used the Internet for health information, the time has clearly come to focus more attention on the role of the Internet as a health educator. Additional research on several related issues would be helpful, including the quality of online health information for young people and the role of search engines in shaping what information is found. If the quality of online information is not high, increased reliance on the Internet could lead to greater misinformation and skepticism.

### **Cost effectiveness of teledermatology on patients with suspicious pigmented skin lesions sifting**

L. García-Mochón<sup>a,\*</sup>, A. Olry-de-Labry<sup>a</sup>, D. Epstein<sup>b</sup>, C. Bermúdez-Tamayo<sup>a</sup> (*clara.bermudez.easp@juntadeandalucia.es*), L. Ferrándiz-Pulido<sup>c</sup>

<sup>a</sup>Andalusian School of Public Health, Granada, Spain

<sup>b</sup>York University, York, United Kingdom

<sup>c</sup>Virgen Macarena Hospital, Sevilla, Spain

*Background:* Skin-cancer screening should rely on simple, low-cost and high-sensitivity diagnostic procedures. There is a growing interest in teledermatology in today's clinical practice, but the economic evaluation of this technology is still unclear.

*Objective:* 1) To estimate cost of two alternatives for the diagnosis of pigmented skin lesions: Conventional dermatoscopy in vivo at specialized care center and dermatoscopic teleconsultations at a primary care center. 2) To determine the relative effectiveness of each strategy, and to perform an cost-effectiveness analysis.

*Methods:* A decision analysis was performed. Initially, an activity map was developed for both approaches to estimate direct cost throughout the Activity Based Costing methodology (ABC). Indirect costs were also calculated about patient's productivity loss and transportation fees. Effectiveness data were found out from biomedical literature and from a non-published review of Andalusian Agency for Health Technology Assessment. The difference between true positive cases and lost positive cases (Effective cases) was used as outcome for cost-effectiveness ratio and marginal cost-effectiveness calculations. Finally, sensitivity was evaluated in both approaches.

*Results:* Median costs per hypothetical patient was 136 € for teledermatology and 155 € for conventional dermatoscopy in vivo (marginal cost 19€). Effective cases percentage was 28.8% and 22.8% for telediagnosis and conventional system respectively, with a marginal effectiveness of 6% in favour of teledermatology.

*Conclusion:* Teledermatology system is a more cost-effective strategy, therefore conventional dermatology strategy is dominated by the telemedicine strategy. Sensitivity analysis confirmed the strength of results.

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## Interactive tele-education in orthopedics and orthopedic trauma using Internet based videoconferencing

W. Glinkowski<sup>a,b,d,\*</sup> ([w.glinkowski@parser.com.pl](mailto:w.glinkowski@parser.com.pl)), K. Małosa<sup>c,d</sup>, S. Pawlica<sup>b,d</sup>, K. Marasek<sup>d</sup>, A. Górecki<sup>a</sup>

<sup>a</sup>Chair and Department of Orthopedics and Traumatology of Locomotor System, Center of Excellence “TeleOrto”, Medical University of Warsaw, Warsaw, Poland

<sup>b</sup>Department of Anatomy, Center of Biostructure, Medical University of Warsaw, Warsaw, Poland

<sup>c</sup>Multimedia Department, Polish-Japanese Institute of Information Technology, Warsaw, Poland

<sup>d</sup>Polish Telemedicine Society, Poland

**Background:** The use of videoconferencing systems through the Internet brings new connections among physicians around the world without the limits of distance. The information age is revolutionizing medical education. The use of videoconferencing systems through the Internet connects physicians around the world without the distance limitations. Continuous Medical Education of each medical specialty is slowly introduced and requires further progress to provide update for practicing physicians. Most of physicians require reorganizing practice and looking up for replacement when attending physician is going to update being located remotely. New techniques presented during conferences and updating courses require seeing first how the skilled surgeon is doing it. Live transmission was often suggested tool for updating. The Academic Centers usually present live practical skills techniques or surgeries during stationary courses on site. Relatively rarely attendees of may have an opportunity to attend the net conference offering live practical observation via internet.

**Objective:** The aim of the study was to evaluate applicability and usefulness of Web based Conferences and Congresses (national with international participation and fully international) presented over the Internet on topics related to orthopedics and orthopedic trauma.

**Methods:** Application based on (Macromedia) Adobe Flash Player program was set for videoconferencing system. The chat has been established and followed by the Webinar allowing chat interactive communication. The quality of the image transmitted during the Webinar was mostly screen size and resolution dependent. Lectures, Images and live movies send via Flash Enhanced videoconference were seen in real time. Teleeducation team delivered nationwide and worldwide interactive videoconferences accessible through the Internet.

**Results:** From Nov 2005 to Jan 2007 more than 200 attendees accessed our conferences online. More than 95% assessed positively not only relatively small screen but also topics presented. New software developed by co-authors has been implemented for Internet accessible videoconferencing. Application utilizing Adobe Flash Player software was set on videoconferencing system. The Real Time Messaging Protocol was implemented for multimedia communication. Acceptable quality of Webinar was confirmed. The best resolution was achieved on Radiology workstation PC screen. Internet based Flash Enhanced Videoconference was found a useful and attractive media for orthopedic lectures. The part of the group lives in rural and suburban areas. Most of participants work in hospitals. Over 80% of

participants were physicians. There was no fee for the participant. Good quality Web camera was used to snap video for the broadcast over the Internet. Online and offline Internet based videostreaming was utilized for distance-education system.

*Conclusion:* The Internet as an international communication network between international centers of excellence allows multidisciplinary exchange of medical information among specialists from different countries and cultures. Improvements in videoconferencing systems, accepted by lecturers and participants, permit interactive distant communication and decrease their costs. Teleeducation videoconferencing seems to enable providing and receiving CME credits without traveling long distances. Flash enhanced Web seminars may not replace in person conferences or lectures but Webcasting become supplement to other Continuous Education activities.

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## Global healthcare via integration of service into virtual hospitals

G. Grasczew\* ([grasczew@mdc-berlin.de](mailto:grasczew@mdc-berlin.de)), T.A. Roelofs, S. Rakowsky, P.M. Schlag  
*Surgical Research Unit OP 2000, Max-Delbrueck-Centrum and Robert-Roessle-Klinik, Charité – University Medicine Berlin, Germany*

*Background:* Today's patients and citizens that use the health care system are increasingly more active, better informed, more demanding and less deferential to professionals. Citizens worldwide are using information and communication technologies (ICT) to interact with others about their health. This growing acceptance of ICT allows to improve access to information and to effectively deploy technologies for mass broadcast of public health information and education with the goal to develop health services for citizens and patients, taking into account the rights and duties of healthy citizens [1].

*Objective:* eHealth is an important mean for service provision to citizens by improving access to information records and medical experts. The creation of Virtual Hospitals (VH) as leading organisational and architectural concept plays a central role in the integration of medical services. VH support an equal and ubiquitous access to global healthcare for all, anytime, anywhere: ubiquitous Health (u-Health). Examples of dedicated medical services in VH are e-learning and dedicated information portals for professionals and citizens/patients, real-time telemedicine, medical assistance, as well as services for intelligent homecare (thus extending VH into the natural environment of citizens/patients).

*Methods:* Due to the distributed character of Virtual Hospitals, data and computing resources are dispersed over many sites under different administrative domains. Therefore Grid infrastructures and

architectures become a useful approach for the successful deployment of medical applications and provide medical professionals with the required information, computation and communication services [2]. The concept of the Grid should be integrated with other communication networks. In the EMISPHER project a network of distributed medical intelligence has been created by the use of satellite communication. Selected pilot applications such as interactive 3-D visualization of radiological images (BERTA) and high-immersive projections for surgical training (Surgical Table) are currently being adapted and re-designed for operation in a Grid environment. First results will indicate to what extent and under what circumstances Grid can make a difference for global healthcare improvements.

*Results:* Typical examples of clinical services for professionals that are likely to profit from the development and implementation of suitable Health Grid environments are services like acquisition and processing of medical images, data storage, archiving and retrieval, data mining and decision-support systems for evidence-based medicine, simulations and modelling for therapy planning and computer-assisted interventions, as well as large multi-center epidemiological studies. eHealth and Telemedicine also offer great opportunities citizens and patients to solve the problems of an elderly society and healthcare in isolated areas. The area-wide operation of Virtual Hospitals allows efficient homecare especially for the elderly and patients with chronic diseases. Typical service scenarios for homecare are televisits, telenursing, telecare by the general practitioners, as well as remote and computer-assisted acquisition, analysis and evaluation of vital medical parameters like pulse frequency, blood sugar level, internal eye pressure, etc.

*Conclusion:* For a true realisation of global eHealth the integration of a broad range of medical and clinical services into Virtual Hospitals seems pivotal. This requires implementation of Grid-based services-oriented architectures integrated with appropriate communication platforms. Homecare services support that the patient can participate in the community as long as possible and thus will have a major social impact and great potential to relieve the costs of the healthcare system.

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## Determining software value over net savings in clinical workflows

D. Häckl<sup>a,\*</sup> ([dennis.haeckl@hhl.de](mailto:dennis.haeckl@hhl.de)), Ch. Elsner<sup>b</sup>

<sup>a</sup>*Leipzig Graduate School of Management, Leipzig, Germany*

<sup>b</sup>*Wieselhuber & Partner, Munich, Germany*

*Background:* Modern clinical software helps to improve clinical efficiency mainly over information integration and the subsequent clinical workflow improvement. This optimization of clinical workflows is one of the main challenges for hospitals to deal with rising cost and quality pressure. But how can this software driven workflow transformation and the generated value be measured and a standard procedure for comparison be established? Literature suggests several ways but has no standardized measure or methodology to picture effects generated by a software in clinical or generally speaking healthcare environments.

**Objective:** Objective was to reflect the different approaches to measure healthcare software economic effects on different layers and suggest a standardized model for economic software value measurement.

**Methods:** For the standard evaluation a simple standard scheme was developed. The potential was categorized into three blocks: The first block evaluated changes in process times and process landscapes and assigned business values due to saved work- or process time. A second block valued changes in risk management: Risks were valued and the potential change in risk probabilities was estimated. The result was then valued monetary over the statistic minimization of the different risk events. A last block took direct saving into account (changes in staff or other technical equipment). Furthermore an algorithm for the “real” allocation and savings effect was developed. The methodology was then used for the evaluation of different real and fictive scenarios.

**Results:** The methodology turned out to be capable of measuring the different layer effects. However, a big variance was seen in all blocks due to reallocation effects and translation into real cost savings.

**Conclusion:** The measurement of software value through process and workflow effects seems to be capable in certain standardized forms. An exact, standardized and defined methodology is very helpful in comparing effects between different vendors and approaches. However, a problem may lie in the exact measurement of the entry-parameters, which should be measured over field-tests and clinical studies. At last, the “real” impact of changes and improvements in workflows must be evaluated based on the situation of the single client as for example the reallocation rates of resources vary quite high. Case studies can help to estimate effects and real reallocation and direct savings rates.

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## The cost-effectiveness of screening programmes: Example of IT-supported systematic diabetic retinopathy screening

D. Häckl<sup>a,\*</sup> ([dennis.haeckl@hhl.de](mailto:dennis.haeckl@hhl.de)), Ch. Elsner<sup>b</sup>

<sup>a</sup>Leipzig Graduate School of Management, Leipzig, Germany

<sup>b</sup>Wieselhuber & Partner, Munich, Germany

**Background:** Economic evaluation of screening programmes for chronic diseases becomes more and more popular. However, recommendations for healthcare deciders depend both on the respective type of evaluation and on pre-defined requirements. In the age of IT-supported screening systems cost-effectiveness ratios for screening initiatives ratios might drastically change and thus give support for the implementation of such programmes.

**Objective:** The objective of this work was to derive standards for economic evaluation and to discuss an economic model for calculating cost-effectiveness of screening programmes. Furthermore, practical relevance of the model should be shown using the example of systematic diabetic retinopathy screening.

**Methods:** This work uses a 4-step approach. In the theoretical part standards for economic evaluation of healthcare programmes were derived from a work from Drummond et al. [1] and a simple Excel-based simulation model was presented. The model was then applied to screening and treating diabetic retinopathy. At this level, the cardinal principles for screening by the WHO were examined in a first step and secondly the simulation analysis was run with the results being discussed. The model used data from a former study of Polak et al. [2]. In the final step the practical implementation of IT-supported diabetic retinopathy screening was shown in the context of the NHS screening approach in Scotland with Siemens Medical Solutions.

**Results:** The work reveals five main standards for economic evaluation. Furthermore, it shows that screening for diabetic retinopathy meets the WHO's cardinal principles for medical intervention. The results of the economic model are in line with findings of other studies, i.e. screening for diabetic retinopathy in a mixed diabetic retinopathy population is cost effective. Assuming that the service efficiency is at least 85%, the implementation of a screening programme for a population at risk of 8 million people can generate a value of between Euro 21.5 and 1.9 million.

**Conclusion:** Applying standards to economic evaluation is required to increase the validity of results and to compare findings of different analyses. The rough model for calculating the cost-effectiveness of IT-supported systematic screening programmes should be applied to other chronic diseases. Data from the practical implementation of those systems are necessary to underpin theoretical results.

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## Enabling regional expert networks and collaboration – Based on text mining

C. Herzog\* ([christian.herzog@syynx.de](mailto:christian.herzog@syynx.de)), M. Schmidt, J. Dix  
SyynX Solutions GmbH, Cologne, Germany

**Background:** Databases like PubMed containing scientific publications are mostly used for identifying relevant scientific literature. Few available text mining tools allow today the systematic review of expert profiles of scientists.

**Objective:** Support and provoke collaboration of researchers on a regional level – based on natural language processing and text mining routines with which expert profiles are generated from scientific publications.

**Methods:** Based on well established text mining routines author expert profiles are generated from scientific publications and integrated in a web based software tool which allows the user to explore the competence of his colleagues in defined regional areas based on the integration of geographic data.

**Results:** As a result, knowledge maps which clearly present the expertise of an institution, a region or a whole country can be generated.

*Conclusion:* With the chosen approach it was verified that the databases like PubMed can be analyzed, processed and used for regional concept mapping und expert finding. Obstacles like author disambiguation in case of author homonyms have been resolved based on statistical analysis and algorithms.

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## Economic effects of ICD home monitoring over the Internet: A multicenter trial

G. Hindricks<sup>b,\*</sup> ([hindg@medizin.uni-leipzig.de](mailto:hindg@medizin.uni-leipzig.de)), D. Häckl<sup>a</sup>, Ch. Elsner<sup>a</sup>, H. Kottkamp<sup>b</sup>

<sup>a</sup>Leipzig Graduate School of Management (HHL), Leipzig, Germany

<sup>b</sup>Heart Center Leipzig at the University of Leipzig, Leipzig, Germany

*Background:* The number of patients with primary prophylactic ICD implantation rises. Resources for a regular ICD follow-up every 3 months are not available. Additionally patients with primary prophylactic ICD implantation have a lower number of therapy episodes – lowering the need of a close meshed physical follow-up.

*Objective:* The REFORM Study investigated in a prospective, randomized and multicenter comparison study the effect of ICD Home Monitoring (HM) against conventional follow-up in MADIT II patients. For cost measurements a cost model from Leipzig Graduate School of Management (HHL) was used.

*Methods:* 115 patients (86% male, 14% female; 62 +/- 8 years) with CHD, EF < 30% and after MI (> 1 month) received a primary prophylactic ICD implantation (110 one-chamber systems, 5 two chamber systems) with HM function. 3 months after implantation patients were randomized in two groups: 12M = HM and just a single follow-up per year, 3M = normal 3 month cycle for physical follow-up. Primary endpoint was the number of unplanned visits, secondary endpoints were total costs in follow-up vs. HM, Quality of Life (SF-36) and overall mortality. For the calculation of costs in the different arms a HHL model was used in combination with real cost data of the participating centers.

*Results:* The mean observation time was 117 days (23–513 days). The LV-EF was at 24 +/- 6%. The patients spread over NYHA classification as follows: NYHA I = 3%; NYHA II = 50%; NYHA III = 47%; NYHA IV = 0%. During follow-up 60 additional ICD interrogations were necessary. 5 were patient-initiated (3M-group = 1; 12M-group = 4) and 55 physician-initiated (3M-group = 28; 12M-group = 27). Under the assumption, that savings derived immediate due to resource reallocation or reduction the savings per patient and month were at 69 Euro in the 3M group against the 12M group.

*Conclusion:* The simplified ICD follow-up scheme with additional HM in MADIT II patients doesn't cause additional patient visits. Additional significant potential savings in the HM group can be observed.

## Using health smart cards to improve medication safety

M.H. Hsu<sup>a,\*</sup> (701056@tmu.edu.tw), Y.C. Li<sup>b</sup>, J.C. Yen<sup>c</sup>

<sup>a</sup>*Department of Quality and Patient Safety, Taipei Medical University Wan Fang Medical Center, Taipei, Taiwan*

<sup>b</sup>*Institute of BioMedical Informatics, National Yang-Ming University, Taipei, Taiwan*

<sup>c</sup>*Department of Ophthalmology, Taipei City Hospital, Zhongxiao Branch, Taipei, Taiwan*

**Background:** In Taiwan, almost all the population are covered by the National Health Insurance (NHI); people here need to use the health smart cards issued by bureau of NHI when they visited the healthcare organization to utilize the healthcare service.

**Objective:** We try to use the health smart cards in the outpatient service of an acute care hospital to improve medication safety.

**Methods:** In Taiwan, the NHI health smart cards have been used since 1 July 2003, and they have fully replaced the paper-based cards since 1 January 2004. Hospitals must support the cards in order to provide medical services for insured patients. There are four sections of information stored in NHI health smart card, including the personal information, the NHI-related information, the medical services and the public health administration. The contents of medical services section mainly include the drug allergic history, all prescriptions and certain medical treatments. Wan-Fang is a major tertiary-care hospital with 747 beds in Taiwan. It's an affiliated hospital of Taipei Medical University. In this study, we integrated the health smart cards into Wan-Fang hospital outpatient computerized physician order entry (CPOE) system to provide the real time online alert to the physicians. All prescription in patients' health smart cards were read and compared with physician's new prescription to check about potential duplication of drug and drug-drug interaction. The real time alert was offered to the physician by a pop-up window on the CPOE screen.

**Results:** From Jan 1 2007 to Jan 31 2007, there were 63,347 outpatient visits in Wan-Fang hospital. 13,247 health smart cards were read by our hospital information system. The prescription record in 3,194 health smart cards revealed patients still had drugs from other healthcare organization on the day they visited Wan-Fang hospital. The incidence of potential medication duplication was 6.17% and the incidence of the drug-drug interaction was 0.44%. After the online alert, 21% of prescriptions was modified by physicians due to medication duplication and 32% of prescriptions was modified due to drug-drug interaction.

**Conclusion:** As the results revealed, the health smart cards integrated into the CPOE system could be recruited as a component of the hospital information system to improve patient safety, especially to prevent the medication errors. Polypharmacy is a big problem in Taiwan. Since primary care visits are easily accessible in Taiwan, patients might visit different health care providers for the same problem, and used medications provided by different healthcare organizations at the same time. The reminding system using the prescription record on the health smart cards as data source is significant and effective for the prevention of drug duplication and the drug-drug interaction. And the health smart cards might also be viewed as the complementary role of the electronic medical records that is still not mature in Taiwan.

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## Physicians' preparedness to offer electronic consumer health services

N. Huttunen\* (*nora.huttunen@tkk.fi*), K. Jalonen, H. Lano  
*Helsinki University of Technology / HEMA Institute, Helsinki, Finland*

*Background:* Electronic Patient Records are widely used (in year 2002, 94%) by healthcare providers in Finland. At the same time, electronic consumer health services are not commonly used in public health care. There are few ongoing pilot projects, where secured web messaging with physicians and nurses is available. Some eHealth solutions in self care management have also been tested. Despite these pilot projects, we are lacking the break through in using electronic consumer health services fluently in public health care. Our current research project concentrates on charting the needs and eHealth related abilities of patients and service providers.

*Objective:* In Finland, the health centers are responsible of public primary care. We are presenting here a part of the survey study results, done in February 2007, in order to better understand the physicians' preparedness to offer consumer eHealth services.

In this paper we seek to understand the opinions of public primary care chief physicians towards electronic consumer services in general and eHealth services planned for use in primary care.

*Methods:* The survey was sent out by post to all chief physicians of public health centers ( $n = 249$ ) in Finland. The survey instrument was tested beforehand in consultation with five primary healthcare physicians. A statistical analysis of the survey answers was performed by using Microsoft Excel.

*Results:* We received a very satisfactory answer rate of 45% out of total 249 primary care chief physicians, amassing a total of 113 respondents. The physicians who answered vary in their age (the biggest age groups were 40–49 years; 24% and 50–59 years; 64%) and gender (Female 28%, Male 72%) and also in the amount of the target population of their health center (from 3000 to over 30000).

Almost all respondents use email (100%), internet banking (81%) and www browsing (93%) regularly. Use of email for internal communication among physicians and nurses was very common (89%). Also 37% of respondents reported that email was used in their health centre as a communication tool with the patients. The majority (85%) of chief physicians felt that current internal eHealth services in use have affected the workloads positively. The majority (78%) of respondents felt also that the amount of eHealth services should be enhanced.

*Conclusion:* Chief physicians' attitudes towards electronic services and eHealth services were mainly positive independently of responder's age or gender. The results indicate that there is interest and ability among Finnish primary care physicians to develop consumer eHealth services. In the future, when the barriers of adoption of such services [1] have been overcome, the implementation of consumer eHealth services promises to be welcomed by physicians and nurses.

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## HealthFinland – Publishing health promotion information on the Semantic Web

E. Hyvönen<sup>a,b</sup> (*eahyvone@cc.hut.fi*), K. Viljanen<sup>a</sup>, O. Suominen<sup>a</sup>, E. Hukka<sup>c,\*</sup>

<sup>a</sup>*Helsinki University of Technology (TKK), Helsinki, Finland*

<sup>b</sup>*University of Helsinki, Helsinki, Finland*

<sup>c</sup>*National Public Health Institute, Finland*

*Background:* Health promotion information on the web in Finland is produced by tens of professional independent health organizations. As a result, it is difficult for the citizens to find and relate with each other relevant health information scattered at tens of different web sites that have different organizational points of view to the content. A major problem for the health organizations is that overlapping content is created at several sites without mutual co-operation, which leads to high content creation and maintenance costs, unbalanced content production, and varying quality of web pages [3].

*Objective:* To solve these problems we are creating a national, collaborative health promotion information system HealthFinland (“TerveSuomi” in Finnish) on the Semantic Web [1,4]. It provides the citizens with a single portal that aggregates content from different health organizations based on a metadata schema and large shared ontologies and vocabularies, such as Medical Subject Headings MeSH (23,000 concepts), the European Multilingual Thesaurus on Health Promotion (1,200 concepts), and the General Finnish Ontology YSO (20,000 concepts). Information is retrieved using an intelligent semantic faceted search engine [2], and a semantic recommendation system automatically creates links with natural language explanations between content web pages. The system is based on the underlying ontologies and logical reasoning, in the spirit of [2]. For example, since the lung is a part of the body, and smoking causes lung cancer, then it would be possible to infer that smoking is harmful for the body.

*Methods:* The system is based on the newest developments of semantic web search and browsing techniques, Web 2.0 techniques, ontologies, a set of shared ontology library servers, and annotation tools for content creation.

*Results:* A national level model for collaborative, distributed semantic health content creation with new possibilities for content quality control. New methods have been developed for semantic search, browsing, and user interface design [4]. A novel semantic portal design [1,4] and a new kind of infrastructure needed for content creation.

*Conclusion:* A prototype of the system is ready and will be demonstrated at the conference.

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## **Semantic integration – The next level of interaction between standards, regulations and initiatives**

A. Ihls\* (*alexander.ihls@icw.de*)

*InterComponentWare AG (ICW AG), Walldorf/Baden, Germany*

*Background:* Medical data becomes more and more communicated in electronic ways. This is a merit of the digital revolution and was supported by a huge number of national, regional or commercial projects. In the last decade the international healthcare IT business was concentrated on building up standards and regulations to define the protocols and meta-data that are needed to enable an asynchronous communication between different IT systems or actors. To get the support of the users and to reach the regulations most of the healthcare IT systems try to portray the old paper based workflows inside of their functionalities. Meanwhile, the next level of integration is reached, where the borders of organizations and countries will be negotiated and the workflows are in discussion.

*Objective:* To promote the success of semantic integration it will be necessary to choose the right standards, to force the legislations to the right directions and to organize an ecosystem that provides knowledge, tools and components in an open environment.

*Methods:* Starting from an overview of the existing standards and initiatives the landscape of the actual players must be analyzed to come to the final technical and political choices. The main standards that have to be reviewed are not only the known medical IT bodies like HL7 and DICOM but comes also from the industrial IT area. When the technical decisions are clear the development of the ecosystem will become the most important task. The corner points of this system will be presented and discussed. The possible contributors are to be invited and the governments have to become included in the process.

*Results:* The discourse will lead to a couple of tasks that shall inspire the audience to engage in the given results.

*Conclusion:* The healthcare IT community learned from the last 20 years that it might be a long way to enable semantic integration but according to the same experiences it can be shown that it is possible to reach this aim. With a running integration of semantically mapped medical information the vision of specific support of medical treatments through healthcare IT will be in a reachable distance.

## **From research plan to recycled paper: Facing and overcoming eHealth inertia**

K. Jalonon\* (*kari.jalonon@tkk.fi*), N. Huttunen

*Helsinki University of Technology / HEMA Institute, Helsinki, Finland*

*Background:* In the Mednet 2006 conference, the authors presented a research agenda on a consumer eHealth pilot planned to measure the effects of eHealth on efficiency [1]. Since that time, however, the agenda has undergone dramatic changes caused by inertia and uncertainty in the eHealth environment. The eHealth II project aimed at the development of business-to-customer eHealth service models for the care of type 2 diabetes and health examinations in student health care. These models were to be implemented during 2007 and modified for continued use after a trial period.

*Objective:* This paper outlines some of the current challenges in eHealth service construction seen from the point of view of university-based research, and the changes they have caused in the current research project.

*Methods:* This paper is based on the experiences gained during the eHealth research projects at the Helsinki University of Technology. The research has strived to investigate the applicability of eHealth

systems to the Finnish healthcare environment and to develop practical service models to be piloted in partner organizations. This paper uses data from interviews with nurses and physicians, as well as technology developers and architects of national Health Information Technology (HIT) plans.

*Results:* Due to problems concerning technology application, legislative and organizational issues, these pilots had to be postponed. Implementing the developed eHealth solutions as IT products has been slow.

The Finnish healthcare and Health IT fields are very fragmented, and there is little integration and standardization between systems made by different vendors. Due to this technological diaspora, developing marketable off-the-shelf applications is difficult and virtually none exist at the moment. Partly because of this technological division, the focus of national development activities is on the development of technical infrastructure instead of service innovations. The addition of new systems to the numerous IT systems already used in patient work is unwanted. This, and the fact that healthcare professionals already use numerous IT systems in their patient work, makes the addition of new systems unwanted. According to interviews, doctors and nurses feel that without standardization and desktop integration, the addition of new systems would complicate their work.

*Conclusion:* eHealth service development is stalled by the lack of IT standardization and marketable eHealth products, incomplete legislation, and actors' lack of readiness to adopt new service models. The challenge for Finnish eHealth research is to overcome this inertia. The past year's experiences have shown that more research into the involved work processes and needs of the stakeholder groups is needed before electronic consumer services can be extensively implemented in Finland. Instead of pilot trials, the authors currently concentrate on charting the needs and eHealth abilities of patients and service providers. Their focus has shifted from describing the effects of eHealth to enabling its development.

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## Physicians' responses to unsolicited patient requests seeking for medical advice by e-mails – Short study

T. Jaskolski<sup>a</sup>, K. Oussenek<sup>a</sup>, O. Schindler<sup>a</sup>, S. Zoller<sup>b</sup>

<sup>a</sup>*Campus Inform e.V. / University of Leipzig, Leipzig, Germany*

<sup>b</sup>*HHL – Leipzig Graduate School of Management, Leipzig, Germany*

*Background:* Patients demand more and more health advice by the Internet, but – especially professional – medical advice on the internet has not been explored in depth. Eysenbach's study (1998) was reproduced to examine the current situation in Germany: the attitude of doctors toward unsolicited requests by e-mail / WWW was designed simulating an acute medical problem.

*Objective:* In our work a study from 1998 from Eysenbach was redesigned to investigate the situation in Germany: To explore the attitude of physicians toward unsolicited e-mails a request was composed simulating an acute medical problem.

*Methods:* All addressed physicians had a comparable specialism and were selected randomly over Germany. The request was sent out by e-mail / internet forms to 128 doctors. After a period of time, we contacted the physicians with an explanation about our request and added a short electronic questionnaire

demanding for their attitudes towards medical advice by internet forms / e-mail. The feedback (medical advice and questionnaires) were counted, analysed and evaluated on basis of a score card.

*Results:* Exactly 50% of the Emails were answered, 8.5% didn't reach the hospital and the rest was not answered. 67% of the answering doctors replied after 24 hours. 42% diagnosed right and 11% mentioned, that online health advice is illegal. 11% get over 50 e-mail requests in a consulting matter per day and 22% of the doctors would consult online if they would be reimbursed. 89% of the doctors are sceptical against online health consulting. In our Scoring System only 2 of the reply e-mails reached all criteria to be a "valuable business service".

*Conclusion:* Patients seek for health information on the WWW. Due to the fact of missing general policies and standards how to react on requests, doctors are uncertain concerning this kind of medical consulting. They expect more risks than potentials. E-mail health consulting services seem not to be too worthful business model at the moment but might be an added value service embedded in a special framework, e.g. with known patients over long distances in combination with multimedia technology.

### **Health virtual communities: A new patients' experiential knowledge source**

J. Jiménez-Pernett<sup>a,\*</sup> ([jaime.jimenez.easp@juntadeandalucia.es](mailto:jaime.jimenez.easp@juntadeandalucia.es)), J.F. García-Gutiérrez<sup>a</sup>,  
C. Kephaliacos<sup>b</sup>, M.P. Bès<sup>c</sup>

<sup>a</sup>Andalusian School of Public Health, Granada, Spain

<sup>b</sup>Laboratoire Dynamiques Rurales, UMR n° 1937/UTM-ENFA-ENSAT, Toulouse, France

<sup>c</sup>Centre d'étude des rationalités et des savoirs (Cers) Toulouse University – Le Mirail, France

*Background:* The virtual communities on health topics are promising technologies on the increasing diffusion of "eHealth". The high potential of this technology and its large diffusion contrasts with the lack of research in this field. Such technology would congregate a large amount of patients' experiential knowledge, a resource that can contribute to the relevance and quality of health care and biomedical research. However, its deliberate use in health care system would require a more structural approach. An institutional economic analysis of such technology is then required.

*Objective:* To describe the use and outcomes of virtual communities, by applying an institutional economic framework, in terms of health topics, utilization rates, structure, rules of performance and funding models.

*Methods:* A descriptive study by searching with keywords in the main online search engines (Google and Yahoo) was carried out to identify the most visited patients' virtual communities in Spanish. Virtual communities was identified and selected by fulfilment of predefined inclusion criteria. Afterwards, a cross-sectional survey, by a self-administered "ad hoc" questionnaire was sent to the chairpersons and webmasters of health virtual communities selected. Descriptive statistical analyses were performed for all the survey items.

*Results:* More than 50 virtual communities involving only patients and their family members were surveyed. These communities cover a wide range of health topics and stakeholders [Patients' associations (32%), government agencies (23%), academic institutions (34%) and the media (7%)]. Seven types of rules, which represent various performance levels from virtual communities, were identified: position rules, boundary rules, scope rules, authority rules, aggregation rules, information rules and payoff rules.

*Conclusion:* Empirical evidence from this work shows how virtual communities may explicit patients' demands, ideas and judgements. Some general recommendations are proposed to enhance the exploitation of patients' virtual communities within health care system. Further research is needed to evidence the effectiveness of such technologies on clinical outcomes or patient empowerment.

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## e-Health services for motivating the elderly towards better self-care

A. Juntunen\* (*Anitta.Juntunen@kajak.fi*)  
*Kajaani University of Applied Sciences, Kajaani, Finland*

*Background:* The utilisation of Information and Communication Technology as a key to developing services in support of independent management of the elderly can also be applied in Finland [1,2]. The E-Health Services Supporting Home Care project aims to develop care processes for the home care client and artificial hip joint patient in the Kainuu region. The project is funded by the European Union through the Innovative Actions of Eastern Finland Programme (2006–2008) – Welfare technology as an instrument of social innovations [3].

*Objective:* To create, pilot and produce the e-Health model supporting self-care for elderly home care and artificial hip joint replacement patients. To develop the technological environment for e-Health by utilising existing technology. To chart the usability, feasibility and economic efficiency of the e-Health services.

The main task of the project is to create an e-health model supporting and motivating the elderly to participate in self-care. The target groups are the clients in rural areas requiring home nursing care services once or twice a month, and the elderly preparing themselves for an artificial hip joint replacement operation. Ten home care and ten artificial hip joint patients are participating in the pilot.

*Methods:* Home care patients and artificial hip joint patients practice self-care and rehabilitation according to a personally-tailored e-Health programme for self care. The project equips the patients with TV screen, PC, keyboard, remote control, finger print reader, camera and microphone. The self-care programme includes a service in which an electronic programme provides a regime for self care and rehabilitation. The programme shows the documented tasks for a patient, retains and reports the activities undertaken and records the changes in patient condition. Nurses can make observations from the report for the purposes of supervising and guiding the patient's rehabilitation. The patient is able to join the network of patients through video conferencing, participate in e-group activities and access entertainment programmes on television and radio. e-Doctor's services are available to home care patients in their own homes. Data on costs and patient experiences are collected by means of documents and interviews.

*Results:* The model, through which home care and artificial hip joint patients are supported and motivated to be active in self-care. The self care programmes on the Internet. The charting of the usability, feasibility and economic efficiency of e-Health technology and services.

*Conclusion:* The model developed in the project is based on the needs of users and customers and promotes welfare for elderly living in rural areas. At the same time the model generates new business activities in the field of welfare services.

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## Teleconsultation in maxillo-facial surgery and stomatology: A 2-years experience

D.K. Kalinovsky<sup>a,\*</sup> ([dmitry.kalinovsky@dsmu.edu.ua](mailto:dmitry.kalinovsky@dsmu.edu.ua)), I.N. Matros-Taranets<sup>a</sup>, A.V. Vladzimirsky<sup>b</sup>

<sup>a</sup>Donetsk State Medical University, Donetsk, Ukraine

<sup>b</sup>R&D Institute of Traumatology and Orthopaedics Donetsk, Donetsk, Ukraine

*Background:* Background of this abstract is to explain our positive experience of teleconsultation in maxillo-facial surgery and stomatology.

*Methods:* Since September 2004 we have started the project “Telesurgery and Teletraumatology of the Maxillo-Facial Area, Telestomatology” within the framework of the project “Telemedicine in Ukraine” ([www.mfs.dsmu.edu.ua/eng/telemedicine.htm](http://www.mfs.dsmu.edu.ua/eng/telemedicine.htm)) [1]. We used different technologies: e-mail, ICQ, www-site, mobile technologies (MMS, SMS).

*Results:* During 2 years we performed 102 teleconsultations (TK), 13 of them were on the level of the town, 14 of them - on the regional level, 21 of them – on the state level, 54 of them – on the international level (Russia, Lebanon, Kazakhstan, Germany, Austria, Azerbaijan, Great Britain, Italy, Portugal, Syria, Solomon Island, USA, Uzbekistan). We performed 15 TK as abonents, 87 TK as consultants. 58 TK were performed with a help of e-mail and ICQ, 29 ones – with the help of www-site (the special form located in our site, internet-forum), 15 ones – with the help of means of mobile communication (SMS and MMS) – the variant of “synchronic teleconsultation” [2]. 20 TK were performed to confirm a diagnosis and treatment tactics of tumors and tumor-like diseases of face and neck, 19 – traumatic injuries of bones and soft tissues of face and combined traumas, 16 – inflammatory diseases of the maxillo-facial area, 14 – to planning of reconstructive and plastic operation, 10 – to confirm a diagnosis and treatment tactics of TMJ diseases, 7 – illnesses of a teeth and mucous membrane of an oral cavity, 8 – birth defects, 6 – dental implantation, 2 – decision of the question about occlusal rehabilitation. The analysis of the TK performed gives us the opportunity to make the Good (Best) Practice Model (GPM), approved by ISfTeH ([http://www.isft.net/cms/index.php?good\\_practice\\_models](http://www.isft.net/cms/index.php?good_practice_models)).

*Conclusion:* We performed the greater part of the TK as consultant (85.3%), on the international level (52.9%) and with the help of e-mail and ICQ (56.7%). The spectrum of the discussed problems was dedicated to all the aspects of maxillo-facial surgery and stomatology. All the TK performed gave the opportunities to confirm a diagnosis and correct plan of patients’ treatment. The GP developed on the basis of lead teleconsultations is offered to use by maxillofacial surgeons and stomatologists, and also the adjacent experts spending teleconsultation concerning maxillofacial surgery and stomatology.

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## **Predictive value of informational technologies in diagnostics of IUGR**

N.M. Kamilova\* (*nigar65@mail.ru*), I.S. Magalov\*

*Department of Obstetrics and Gynecology, Azerbaijan Medical University, Baku, Azerbaijan*

*Background:* Intrauterine growth retardation (IUGR) is still one of the important problems in obstetrics and perinatology. This is explained by persistent high rate of perinatal morbidity, which often leads to various disorders of neonatal and infant age. According to literature 5–17% newborns had IGR. 2/3 of them were preterm delivered. Perinatal mortality in IUGR makes 19–28% depending on such factors: onset, background diseases and pregnancy complications.

*Objective:* Modern understanding of the role of some risk factors and qualitative estimation of infant health in various communities ground and precondition sciences based and methodical approach to prediction of perinatal pathology. Great importance is attached to clinical evaluation of anamnestic records, their correlation with disease symptoms and outcome.

*Methods:* Thus, it is necessary to apply information systems. The risk groups were revealed by monitoring. The database for monitoring included several tables: social and biologic anamnesis, obstetrical and gynecologic history, extragenital diseases, pregnancy complications, and fetal wellbeing characteristics. The given model was simple to use, open and informative at the same time.

*Results:* 346 pregnant women were involved in the study. IUGR was diagnosed in 12.3% at the 29–31 week of gestation and in 20.3% – at the 32–35 week of gestation.

*Conclusion:* It was proved that the earlier onset of the pathological process predispose more severe course and worse outcome.

## **Increase of hospital efficiency by introduction of guidance system for patients**

S. Kirchmann\* (*stephan.kirchmann@xevit.com*)

*xevIT net works, Ettlingen, Germany*

*Background:* Internet in Healthcare is often used to optimize the collection and access of information – e.g. electronic patient file or hospital information system (HIS). However a large potential to increase efficiency and quality in hospitals is the control of patients – the right patient at the right time at the right place equipped with the right information.

*Objective:* The objective of the guidance system is to increase the efficiency of the hospital by optimizing the workflow of patients and staff. The guidance system provides the patient with real-time information in order to guide him to the right place at the right time in the hospital and therefore reduces its average cycle time. Staff has the possibility to inform patients in time when they are due for treatment so staff can work without interruption. As soon as the patient enters the room, staff automatically gets displayed the relevant patient data. As the guidance system provides the possibility to identify the patient unambiguously it helps to avoid error in treatment. In order to keep investment for hospitals low, the guiding system should use an existing communication infrastructure – Wireless LAN (WLAN).

*Methods:* Each patient receives a wrist band that can send and receive WLAN signals. The information which rooms/examinations the patient has to visit is transferred to the guidance system that identifies the location of the patient (wrist band) and calculates the way to the rooms where the patient is to be expected. The result (turn left/right, go ahead, etc.) is displayed on large screens at each relevant intersection at the hospital/campus. The system works similar a GPS for cars but on a WLAN infrastructure as it is more

accurate and in the complete building available. When staff is calling for a patient he receives a signal at his wrist band. As soon as the patient enters the room, it is recognized and a message is sent to the HIS in order to display the relevant data of the patient.

*Results:* As the system is currently under development, we did face-to-face interviews with hospitals in order to evaluate potential efficiency gains by using the guidance system. All of them identified it as a way to improve workflow of staff and improve quality of treatment. Also patient satisfaction is expected to increase due to shorter cycle times and effective guidance through the building/campus. Additional benefits the hospitals mentioned are: (i) customized information for a patient when he passes the screens, (ii) integration of internal transport services, (iii) alarming of staff and localization when the patient is pressing an alarm button at his wrist band.

*Conclusion:* Hospitals expect guidance systems for patients as a method to improve efficiency – both for patients and staff.

### **Managerial discussions between health insurer and hospital: Using the patient's view on health care values**

S. Klein\* (*susanne.klein@tk-online.de*), M. Jochem  
*Techniker Krankenkasse, Hamburg, Germany*

*Background:* In view of the increasing economical pressure on both hospitals and insurers in Germany, Techniker Krankenkasse (TK), one of the country's biggest health insurers (more than 6 million people insured) has started managerial discussions on outcomes with the key hospitals on a regular basis. Topics include the length of stay and the rate of re-hospitalisation. But hitherto there was – apart from isolated complaints about single aspects of hospital treatment – no standardized method to bring the patient's view into the focus. TK has therefore started a survey on patients in 200 hospitals with the highest number of TK-insured patients. For 2005/2006, more than 130,000 patients selected to take part in the survey, which started in October 2006. The response quota was very high at about 60 per cent.

*Objective:* To monitor patient's satisfaction with the hospital, the survey will now be conducted on a monthly basis, asking all TK-insured patients in the key hospitals about two months after their stay.

*Methods:* Survey on 132,000 patients in 200 hospitals, conducted in October/November 2006. Rate of response: about 60 per cent. The results of the survey will be published on the Internet and will be part of the presentation.

*Results:* Results of the survey are expected to be in early spring 2007. TK will present these results, a possible correlation between the fulfilment of patient's requirements on soft factors and the self estimated result of the medical treatment, and the first results of managerial discussions with hospitals on the findings of the survey.

### **When the Internet of Things connects to the "real world": RFID integration & communication in hospitals**

O. Koch\* (*koch@do.isst.fraunhofer.de*)  
*Fraunhofer-Institute for Software and Systems Engineering (ISST), Dortmund, Germany*

*Background:* The optimization of clinical workflows is one of the main challenges for hospitals to deal with rising cost and quality pressure. The use of RFID technology in hospitals indicates a large potential especially in the area of automatic documentation and accounting of medical treatments.

*Objective:* Objective of this work was to draw an overview of business and process scenarios and roughly estimate the different process and economic impacts of different RFID Use-Case scenarios.

*Methods:* For the Evaluation of the Impact a simple standard scheme was used. The potential was categorized into three blocks: The first block evaluated changes in process times and process landscapes and assigned business values due to saved work- or process time (e.g. faster throughput of Blood conserves).

A second block valued changes in risk management: Risks were valued and the potential change in risk probabilities was estimated. The result was then valued monetary over the statistic minimization of the different risk events (e.g. Patient Death due to Medication Error).

A last block took direct saving into account (Changes in staff or other technical equipment). For single scenarios also – if possible a Cost/QALY Calculation was performed (for cases with risk minimization of patient harms).

*Results:* As a result a standard scheme/procedure for a Hospital RFID Business Case Scenario Evaluation was designed, that can be used for evaluation purposes. For three example scenarios an in-depth analysis was performed.

*Conclusion:* RFID seems to have high impact especially on process designs in hospitals. Savings and Business Value is mostly not a fact of direct savings, but results mostly from indirect process improvements and risk minimization effects. Our tool is able to graph these effects systematically.

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## The STI outpatient clinic online – The use and efficacy of online Syphilis testing and the development of full-scale STI & HIV testing and notification applications online

R. Koekenbier<sup>a,\*</sup> ([rkoekenbier@ggd.amsterdam.nl](mailto:rkoekenbier@ggd.amsterdam.nl)), H. Fennema<sup>b</sup>, E. van Leent<sup>c</sup>, U. Davidovich<sup>a</sup>

<sup>a</sup>Unit of online research, Department of research, Amsterdam Health Service, Amsterdam, Netherlands

<sup>b</sup>Cluster infectious diseases, Amsterdam Health Service, Amsterdam, Netherlands

<sup>c</sup>STI Clinic Amsterdam, Amsterdam Health Service, Amsterdam, Netherlands

*Background:* Syphilis is a re-emerging Sexual Transmitted Infection (STI), among men who have sex with men (MSM). Between 1998 and 2005 the total number of early Syphilis cases in Amsterdam increased from 35 to 249. To respond to the current epidemic the Amsterdam health service (AHS) sought a way to lower the threshold for syphilis testing. To achieve this, we developed a testing website for Syphilis.

*Objective:* To determine the feasibility, usage and efficacy of the online syphilis testing service.

*Methods:* The study was conducted over 15 months. Active recruitment took place only in the first 4 months by way of banners which motivated men to visit the website [www.syfilistest.nl](http://www.syfilistest.nl). The website provided the possibility to download a referral letter with which MSM could get tested for syphilis, free of charge and anonymously in a non-clinical setting. A week after the test, participants could retrieve their results online. Men with positive test results were requested to visit the STI clinic in order to confirm the test result by an interview or a re-test, and if necessary, receive treatment. To determine

feasibility and efficacy of the intervention we compared the online sample with a sample of visitors of the Amsterdam STI clinic.

*Results:* During 15 months the website received 25671 visitors, 898 downloaded a referral letter and 10.4% (93/898) got tested. Of the testers, 96% (90/93) obtained their test results online. Of these, 15.1% (14/93) had a positive serology versus 21.9% (1284/5852) at the STI clinic. Among the online testers, 35.7% (5/14) had an early syphilis and 14.3% (2/14) a (late) latent syphilis, compared to 20.7% early and 4.6% (late) latent syphilis at the STI clinic. Resulting in 50% (7/14) of the men tested online receiving treatment compared to 24.8% (319/1284) in STI clinic. Of those tested positive, 33% (3/10) never visited the STI clinic before.

*Conclusion:* The online testing for syphilis is feasible and successful in detecting men with an early or (late) latent Syphilis. The internet emerged as a medium where people can be informed about STIs and take direct action to address their concerns. Based on these findings the AHS is developing a full-scale STI/HIV online testing procedures. In this full-scale procedures, asymptomatic men will be encouraged to arrange an online test for Syphilis, Chlamydia, Gonorrhoea, Hepatitis B and HIV. Symptomatic men will be directly referred to the STI clinic for direct treatment. The service is scheduled to be launched in July 2007 and will include an evaluation of the usability, (emotional) acceptability, efficacy and cost-effectiveness of the tool. In addition, the AHS is developing a test results notification application for visitors of the STI clinic. Visitors of the STI clinic will soon have the option to login with the personal code and collect their diagnoses and treatment instructions online. The STI notification site is scheduled to be launched in April. Preliminary results of the evaluation both projects will also be presented.

### **Knowledge management in medical online information**

M. Kutschera, H. von Freyberg (*contact: steffen.zoller@cocomore.com*)  
Cocomore AG, Frankfurt, Germany

*Background:* Patients are getting ever more involved with decisions on therapy. Be it that they take decisions themselves such as purchasing OTC medication; be it that they interact in the decision making process with physicians and other medical professionals. To do so in a satisfactory way patients need medical information which is accessible to non-professionals and covers their specific needs.

*Objective:* This paper is intended to explain how consumer-oriented knowledge management principles can guide the development of a medical online information system catering to modern patients.

*Methods:* The paper uses an existing pharmaceutical information platform (Questimed) as an example to discuss knowledge management. It shows the main requirements of successful consumer-oriented knowledge management and describes how those requirements can be applied in a medical context.

*Results:* Knowledge management in medical online information can help patients better understand pharmaceutical issues and gives advice to patients interactively. User statistics of the Questimed platform will show for which sorts of drugs patients seek most information.

*Conclusion:* Medical online information systems provide intensive information for patients and will thus gain in importance. Yet, certain requirements have to be met so that the platforms are consumer-oriented and provide a real benefit to patients.

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## Collaborative virtual environments as research and teaching instruments in the field of emergency and disaster medicine

F. La Mura<sup>a,\*</sup> (*flamura@mclink.it*), G. Franceschinis<sup>b</sup>, F. Della Corte<sup>a</sup>

<sup>a</sup>SCDU Anestesia I, Università del Piemonte Orientale “A. Avogadro”, Piemonte, Italy

<sup>b</sup>Computer Science dept. Università del Piemonte Orientale “A. Avogadro”, Piemonte, Italy

*Background:* Emergency medicine deals with the stabilization and the treatment of patients who suffer from pathologies that evolve very rapidly and that carry a high mortality risk if no effective measures are taken within a short time. In such a situation there is an ideal relation between resources and necessities. Disaster medicine has to face cases where the available resources are less than the case would require.

*Objective:* The e-DISTRICT CiPro project [1] (European DISTance TRaining Interactive and Collaborative Tools for the Civil Protection) involves 11 partners of 6 different European countries (Italy, Belgium, Ireland, Romania, Spain, Hungary). It is a two-year project within the EU “Leonardo da Vinci” programme. It was started in October 2004 and ended in November 2006. The e-DISTRICT CiPro Project allowed the realization of a distance-learning system organized in learning modules in SCORM format and a 3D virtual reality simulation environment suitable for many users. This latter allows the training of the rescue units (doctors, paramedics, civil protection volunteers, fire brigades) in order to guarantee that the protocols are well known and are put into practice in a coordinated way by all the parts active in the operations.

*Methods:* The system architecture has a typical client-server framework constituted by three main components: the student interface (player client), the teacher interface (drills designer client) and the game server. The functional mechanism integrates a virtual worlds 3D simulation engine and dynamical web pages: the general principle is still valid, with some adjustment, for every virtual reality simulation engine that serves to create dynamic web pages. The 3D client is based on the Blaxxun [1] technology.

*Results:* Among the strong points of the simulator used within the e-DISTRICT CiPro we find:

- 1) 3D simulation supplied via Internet with the possibility of:
  - a) forming help squads (also constituted by a large number of rescuers)
  - b) creating communication channels among the squads
  - c) recruiting a huge number of players due to fact that it is possible to use the simulator from one’s own PC
- 2) Realistic representation of the key elements:
  - a) of the scenario: infrastructure, damage to the infrastructures which makes their access difficult, environmental elements that make understanding of what is happening in the scenario more or less difficult: smoke, rubble, fire and structural collapse impair the vision
  - b) of the patients: in the “patient simulators” of the commercial kind vital parameters are represented through numbers on the screen. In our case, as an example, the evaluation of the respiration frequency – as in the triage of the START kind – will be done by literally observing the inspiration and expiration movement, as it is in reality.

*Conclusion:* The philosophy of the e-DISTRICT CiPro is to allow the customization of learning contents. Visualization made within a virtual collaborative environment is useful in order to learn how to react to hostile conditions or environments and also to understand the interfacing problems with the other game figures [3].

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## Electronic patient charts online: A design perspective

P. La Mura\* ([plamura@hhl.de](mailto:plamura@hhl.de))

Leipzig Graduate School of Management (HHL), Leipzig, Germany

*Background:* The online treatment of medical data is a topic of great social relevance, due to the large potential payoffs for patients and medical institutions alike. Yet, several unresolved issues are holding back the deployment of a collaborative online database for medical records, ranging from the magnitude of the necessary investment and coordination effort to the necessity of a suitable regulatory framework to protect the patients' rights to privacy and anonymity.

*Objective:* Objective of this work was to develop a systematic phenomenological view on the architecture of motivating mechanisms / incentives of current and ideal systems for a scenario of health records online.

*Methods:* For the work a concept mapping of current incentive mechanisms and current regulatory and reimbursement scenarios was done. In contrast an ideal scenario was drawn with an economic viewpoint from the systemic "bird's eye view" perspective. In a first step the current state of affairs was addressed, focusing on the identification of the relevant stakeholders, their expectations and their needs. Next a design perspective was focused, and the type of regulatory structure needed in order to align the incentives of the different stakeholders was addressed.

*Results:* A rough overview of an ideal motivation and incentive scenario to foster the development of a collaborative digital platform for medical data was developed.

*Conclusion:* The developed model can be useful for the design and redesign of current eHealth Architectures and can help to structure eHealth reimbursement discussions.

## Evidence based IT: Adaption of the concept of evidence-based-medicine to eHealth

P. Langkafel\* ([peter.langkafel@sap.com](mailto:peter.langkafel@sap.com))

SAP AG, Berlin, Germany

*Background:* Modern Information Technology (IT) can be a key enabler for improved or adopted business models. The healthcare sector is in a process of industrialisation and the decision making process of IT is changing too. Cost-benefit models have to be in the focus of the election process – less "functions & features". But "traditional" ROI-(return on investment) studies with their pure economic focus have limitations which do not fit to the complex healthcare world.

*Objective:* The illustration and explanation of the concept of evidence-based-medicine (Sackett) adapted to information technology.

*Methods:* Different methods of analysing benefits/value of IT are presented: Public ROI, Public Value Model, different Cost-Benefit concepts of national health-record project.

*Results:* The concept of evidence-based IT is a useful method for the classification of IT result, also the “scotoma of evidence-based medicine” (Sackett) the economic part has to be introduced.

*Conclusion:* There is no common and accepted model to evaluate the use of IT. This is urgently needed to be able to discuss upcoming eHealth scenarios within a political, technological and economical framework for a decision-making process.

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## Impact of a computer-alert program linked to the electronic patient record in the prevention of venous thromboembolism in hospitalized patients

R. Lecumberri, J. Paramo, M. Marques, A. Garcia-Mouriz, M.T. Diaz-Navarraz,  
N. Garcia\* (*ngarcia@unav.es*)  
*Clinica Universidad de Navarra, Pamplona, Spain*

*Background:* Information and communication technologies are powerful tools in medicine. However, few studies have been done in clinical settings and little is known about their current possibilities. Venous thromboembolism (VTE) is a common potentially life-threatening complication in acutely ill medical patients. However, prophylaxis against VTE in hospitalized patients remains underused. We hypothesized that the use of a computer-alert program to encourage prophylaxis might reduce the frequency of VTE among high-risk hospitalized patients.

In the context of the first safety campaign in our centre, we developed an electronic alarm linked to our electronic patient record in order to reduce the incidence of VTE.

*Objective:* To implement an electronic alarm in the electronic patient record and to evaluate the impact of this measure both in the incidence of deep venous thrombosis and in the prevention protocol adherence rate.

*Methods:* A computer program linked to the database of patients admitted to the University Clinic of Navarra (UCN) was developed to identify hospitalized patients at high risk for VTE in the absence of prophylaxis. The responsible physician of patients at high risk received an electronic alert, but was free to adopt the decision of whether or not to order the appropriate thromboprophylaxis, that may include physical (compression stockings or pneumatic compression) or pharmacologic prophylaxis (low-molecular weight heparin).

*Results:* In the first year after the implementation of this electronic alarm, the incidence of VTE in our hospitalized patients declined from 4.1/1000 admissions to 2.3/1000 admissions. The rate of protocol fulfilment increased, from 30 to 65% in medical departments and from 80 to 90% in surgical departments.

*Conclusion:* The use of an electronic alarm can be effective in reducing the incidence of deep venous thrombosis in hospitalized patients. The capabilities of an electronic health record can be used to improve the quality of health-care.

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## Internet and medical/pharmaceutical information – Development of this direction in Ukraine and Russia

A.A. Lendyak\* (*alendyak@doctor.ua*)  
*Lviv National Medical University, Lviv, Ukraine*

*Background:* Today one can notice the rash development of medicine and pharmacy. Nowadays the necessity appears for modernizations in systems of medical and pharmaceutical information of the post-USSR countries because of the wide range of diseases, methods of treatment and quantity of available drugs on the markets. Existing systems in modern circumstances, in conditions of limited labor and financial resources, and large implantation of evidence-base medicine, often can't effectively satisfy the requirements of population and health professionals in medical and pharmaceutical information.

*Objective:* The objective of this work was to determine the efficiency, performance requirements and financial practicability of using new for post-USSR countries systems of medical and pharmaceutical information, which are based on the data communications via Internet.

*Methods:* The work was based on the study of Ukrainian project Doctor.UA (non-commercial project which provides health professionals and citizens by quality medical and pharmaceutical information through the Internet, project is launching by JSC "Apteka Doctor"). For deciding given tasks were applied following methods: statistical analyses, usability-testing, interviewing the visitors.

*Results:* Introducing of Doctor.UA is scheduled in several stages. First of all in January, 2003 was opened four-years test project, which was the part of corporative site of the company (<http://apteka-doctor.com>). It was named Pre-Doctor.UA and it in simplified form modeled Doctor.UA. Pre-Doctor.UA has realized following functional units (some units – partially):

- reference information for visitors in different directions of medicine;
- information about drugs which are available on the market (incl. instructions for using);
- teleconsultations;
- information about healthy lifestyle and role of preventive maintenance;
- news of medicine and pharmacy;

During first decade of January, 2007 the results of activity of Pre-Doctor.UA were drew up. For deciding given tasks was analyzed following information: statistics systems, usability-testing, interviewing the visitors. Statistical data of attendances of the whole project and separate it services was explored. The results from three different statistics servers were studied and the index of average attendance of the project was determined: it forms 406 persons daily, the growth was rather essential from at average 27 visitors/daily in 2003, then 244 – in 2004 and 650 – in 2005, to 704 visitors/daily – in 2006. During that time system has processed 33584 inquiries for granting the instructions for using determined drug. Qualified specialists provided more than 1000 teleconsultations in 12 directions of medicine and pharmacy. In 2006, 97% of interviewed visitors ( $n = 300$ ) positively appreciate the idea of launching Doctor.UA.

*Conclusion:* As a result of conducted analysis of activity of Pre-Doctor.UA was stated the necessity of large-scale implantation of Doctor.UA, that is planned to be done during 2007–2009 (in 3 stages). Internet-systems of medical and pharmaceutical information proved their practicability of using in post-USSR countries. In this region such systems effectively solve the main tasks, satisfy requirements of visitors and have a significant popularity. Today the realization of such projects demands investing, however, they have good independent financial perspectives in a short future.

### **Internet-based Cholesterol Assessment Trial (I-CAT)**

S. Li<sup>a,\*</sup> ([stephenl@icpmr.wsahs.nsw.gov.au](mailto:stephenl@icpmr.wsahs.nsw.gov.au)), R. Webster<sup>b</sup>, D. Sullivan<sup>c</sup>, B. Neal<sup>b</sup>

<sup>a</sup>*Institute of Clinical Pathology and Medical Research, Westmead, NSW, Australia*

<sup>b</sup>*The George Institute for International Health, Camperdown, NSW, Australia*

<sup>c</sup>*Royal Prince Alfred Hospital, Camperdown, NSW, Australia*

*Background:* The Internet is used commonly by consumers as a source of information about cholesterol lowering therapy. Interactive tools providing, individually tailored, advice about the need for treatment are increasingly widely available but their effectiveness is unknown.

*Objective:* To determine the effects on consumers' use of cholesterol lowering therapy of an online service that provides automated, individually tailored, advice about eligibility for cholesterol-lowering treatment.

*Methods:* I-CAT was a masked, randomised, controlled trial evaluating the effects of a consumer-mediated electronic decision support tool compared to a static web page with the aim of increasing use of cholesterol lowering therapy according to Australian Pharmaceutical Benefits Scheme (PBS) Guidelines. The trial was open to any adult Australian with Internet access but was directed towards individuals at high cardiovascular risk through a range of targeted recruitment activities. The primary outcome was the commencement or increase of prescribed cholesterol lowering therapy.

*Results:* 2099 participants were randomized and 92% were followed up 8 or more weeks later. 563 (27%) met PBS criteria for cholesterol lowering therapy and about one half of these 258 (12%) were prescribed treatment at baseline. Treatment was commenced or increased in 143 (6.8%) during follow up but half of the changes were not clearly indicated under PBS criteria. There was no detectable difference in the comparative effectiveness of the electronic decision support tool and the static web page with 6.0% in the intervention group and 7.6% in the control group reporting the primary outcome ( $p = 0.2$ ).

*Conclusion:* Many people meeting PBS guidelines for cholesterol lowering therapy were not receiving treatment and many others were. Consumer utilisation of the Internet appears unlikely to greatly improve this situation. The multiple intermediate actions required for consumer use of the Internet to translate into physician prescription of treatment may have been an important factor limiting impact. Internet-based electronic decision support tools targeting consumers appear unlikely to produce large changes in clinical practice.

## The quality of cardiovascular health websites easily accessible to Australians

S. Li<sup>a,\*</sup> ([stephenl@icpmr.wsaahs.nsw.gov.au](mailto:stephenl@icpmr.wsaahs.nsw.gov.au)), R. Webster<sup>b</sup>, B. Neal<sup>b</sup>

<sup>a</sup>*Institute of Clinical Pathology and Medical Research, Westmead, NSW, Australia*

<sup>b</sup>*The George Institute for International Health, Camperdown, NSW, Australia*

*Background:* There is a huge expansion in the delivery and utilization of online health information by professionals and consumers, but there is no universal quality control process or regulatory system that manages the content or quality of health information published on the Internet. There is a need for identifying some simple strategies that could be used by consumers to increase the likelihood of the information they identified being reliable.

*Objective:* To objectively and systematically evaluate the characteristics of health websites accessible to Australians seeking advice about heart disease. Specific goals were to compare the information obtained from searches restricted to Australian pages compared to searches of the World Wide Web and to compare the characteristics of different types of websites.

*Methods:* Search strings widely used to seek information about cholesterol and heart disease were identified through an email survey of consumers and health practitioners. The most frequently used terms – ‘cholesterol’ and ‘heart disease’ were entered separately and together into the three Internet search engines most commonly used in Australia (Google, Yahoo and NineMSN), first searching just Australian pages and then the World Wide Web. The sites listed on the first result page generated by each search were recorded and characteristics of the identified websites were compared using the Content Evaluation Guidelines of the Medical Library Association [1].

*Results:* 109 email respondents suggested a total of 301 key words with ‘heart disease’ (suggested by 89%) and ‘cholesterol’ (suggested by 79%) being the most common by far. 92 discrete websites were identified with 35 identified only by the search of Australian pages, 36 only by the search of the World Wide Web and 21 by both. 13% were ‘government’ sites, 60% were ‘commercial’ sites and 27% were ‘other’ types of sites (mostly operated by not-for-profit organisations). The identity, details and intent of the site sponsor were easily apparent for about four fifths. Half had been updated within the last twelve to twenty four months but key information could be easily verified for less than a half. Information on commercial sites was less easily verified than data on government or other sites (both  $p < 0.02$ ). In addition, information on government sites was more likely to be up-to-date than information on commercial sites ( $p = 0.05$ ). Few sites used interactive technologies to provide information tailored to the individual. The characteristics of websites returned by the local compared to international search strategies was not different ( $p > 0.08$  for all comparisons).

*Conclusion:* Most cardiovascular health websites identified met key quality criteria but government sites were somewhat better. Searches restricted to Australian pages may be preferable since the sites identified were of no less quality and the information returned ought to be of greater local applicability.

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## Electronic management and presentation of Standard Operating Procedures

M. Löbe\* (*matthias.loebe@imise.uni-leipzig.de*)

*Institute for Medical Informatics, Statistics and Epidemiology (IMISE), University of Leipzig, Leipzig, Germany*

*Background:* Having a set of Standard Operating Procedures (SOPs) is an important part of quality assurance in clinical trials. SOPs are practical, mandatory instructions for frequently occurring tasks and contain administrative routine as well as medical procedures. They are usually approved by a consensus vote of domain experts. Easy access to SOPs in their most current version is a crucial factor, especially in multi-site study groups. Electronic SOP management systems with decentralized editing, central administration, workflow and custom metadata will help to ensure quality. Such a web application has been developed within the competence network of malignant lymphoma.

*Objective:* The mission was to establish a central computer-based quality management platform containing all SOPs and associated documents in their latest versions. Requirements were to support the SOP management workflow and to provide views for various user roles: a) an edit view for authors showing the most current version of a SOP, (b) a quality assurer's view for domain experts comprising of those changes that were explicitly submitted for publication and (c) a released ready-to-use view as the main knowledge distribution channel for clinical staff. Another objective was the verifiability of changes made in SOPs. A journal must keep records of every modification for auditing purposes by logging user name, time, action and an optional remark.

*Methods:* The e-SOP management system was built on top of a content management framework that provided a basic data repository. For the creation, modification and verification of SOPs, a HTML client application has been extended with SOP-specific functionalities like a comprehensive metadata schema, visual tracking of changes and layout templates. The client offers a user-friendly interface for editors and quality assurers. Checkout locks prohibit unintentional overwriting. The system supports granular rights at object level. User Management is provided by a LDAP directory service, which stores not only common user data but additionally all organisational groups and functional roles. For different use cases, an online version (HTML) of the SOPs is available as well as a print version (PDF) and a XML-version suitable for data exchange with other e-SOP tools.

*Results:* A centralized infrastructure proved to be a great time and quality advantage over excessive e-mail communication in terms of maintaining changes, layout consistency, versioning and archiving. At present, 84 SOPs have been adopted and 10 editors at 5 sites across Germany are regular users. However, it must be stressed that untrained personnel found it sometimes hard to switch from MS Word to a web based application.

*Conclusion:* In addition to routine operation, new capabilities are being implemented in order to expand the e-SOP management system's application range and to improve its usability. That includes the structural analysis of a SOP's content for context-oriented presentation, the semantic annotation of mark-up elements and the integration of terminology reference systems via web services.

It is planned to use this approach as a basis for the Clinical Trials Center Leipzig and the competence network of heart failure. In the long run, a concept is needed how to integrate such services with existing clinical document management systems concerning homogeneously access, representation, and validation.

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## Hybrid value creation strategies in health care management

E. Matthaei, M. Koelling\* (*marcus.koelling@hhl.de*), K. Mösllein  
*Department of Information Systems I – Innovation & Value Creation, Friedrich-Alexander-University Erlangen-Nuremberg, Nuremberg, Germany*

*Background:* The evolutionary change from product and service enterprises to integrated solution providers clarifies the present paradigm of competition [1]. Following, the borders between product (ion) and services dissolve and hybrid value creation structures evolve, which are characterised by a combination of production and service output. Hybrid products thereby can be described by the intelligent interlocking of physical products and services, which are already closely interconnected throughout the conception and development, and whose single components can hardly be decoupled.

However, in practice and research it can be observed that approaches either cover the development of physical products or the systematic conception of services (see e.g. [3–5]).

*Objective:* The project SPRINT (BMBF, FKZ 01FD0609) aims at the development of empirically founded, integrated product and service models in the health care business. We identified two gaps for further research: an experience gap as well as a model gap.

Our first objective addresses the experience gap and aims at an empirical foundation of the field for hybrid value creation. Our second objective focuses on the model gap. In the integration of product and service models we conceptualise a framework for a holistic analysis and recreation of interactive value creation.

*Methods:* Empirically founded results on methods and models for the integrated development, conceptualization and marketing of hybrid products are missing as well as support with an adequate set of appropriate tools. In particular the systematic development (design) of concrete hybrid products in different industries was so far hardly examined.

With selected case studies we show first fundamental characteristics, design parameters as well as success and/or failure factors of hybrid value creation. With our case studies we find support for innovations strategies of hybrid value creation that contribute to the economic future of regions [6]. Our case study data empirically shows that the phenomenon of hybrid value creation exist across corporate and industry boundaries. Exploratory case study material serves therefore for both, to identify characteristics of hybrid value creation as well as to back the fundament for our framework that makes the compiled know-how available.

*Results:* Empirical data material which makes hybrid best practices available to researchers and practitioners. Success and failure factors of hybrid value creation as well as an analytical framework to systematically model the development, conception and marketing in the health care business.

*Conclusion:* Traditional models for product development and service engineering are however only very limited applicable to map hybrid value creation. They consider not adequately domain-specific characteristics of joint product and service development. The research project is one fruitful insight on the future of value creation with the approach of systemizing the integration of product and service providers in the health care business.

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### **Healthbot.net: Patient education with a natural speaking robot before catheter ablation – Results from 47 patients**

Ch. Mazzi<sup>a,\*</sup>, S. Zoller<sup>b</sup>, Ch. Standke<sup>c</sup>, G. Hindricks<sup>d</sup>

<sup>a</sup>*Bain & Company, Boston, USA*

<sup>b</sup>*Cocomore AG, Frankfurt am Main, Germany*

<sup>c</sup>*Campus Inform, Leipzig, Germany*

<sup>d</sup>*University of Leipzig, Heart Center Leipzig, Leipzig, Germany*

*Background:* Patient education is associated with several desirable outcomes like greater satisfaction and compliance of the patient. HealthBot.NET attempts to use a natural speaking software bot for education, screening and data entry purposes in chronic and acute disease management.

*Objective:* One objective was to give patients independent possibility to (pre)access and enter information speaking “natural” language. Second objective was to provide a conversation overview and screening objective for the doctor.

*Methods:* For the Programming of the Bot we used the Artificial Intelligence Meta Language (AIML). For the Deployment a variant of the ALICE Program D and a Cocoon/Apache Server were used. The Linguistic Analysis was performed over a Special Parser plotting a map of the conversations topics. The Database on therapeutic catheter ablation in AV-Node Re-entry Tachycardia was built by 3-steps of preinterviews with patients. Evaluation was done in two groups with ( $n = 24$ ) and without ( $n = 23$ ) the bot interview. Groups were blinded for the doctor, Patient questionnaires were given during the talk with the bot and Doctor questionnaires were given after each real interview (following the bot interview). The Overview chart for the doctor was not used.

*Results:* Our results with a cohort of 24 patients showed good acceptance of the bot conversation. 43.5% of the botanswers were graded useful / good, 35.8% of the answers were graded bad or not matching. Patients having the bot conversation asked 4.6 questions in average, patients without bot interview asked 3.2 questions in average. In question detail and being well informed we could only see a slight difference between the groups.

*Conclusion:* The resulting platform allows to set up of the bots brain using keyword pattern matching, matching synonyms and determining communication pathways and consecutal questions. Our results encourage our approach in training a bot for specific patient education. Our first version seems to stimulate patients for a deeper and more detailed understanding. For future aspects of the bot patient monitoring and continuous health education could be feasible with the provided tools.

## Electronic Health Record – experiences with the IZIP System

T. Mladek\* (contact: [stanislava.bartova@izip.cz](mailto:stanislava.bartova@izip.cz))  
IZIP Incorporation, Na Bulovce, Prague, Czech Republic

*Background:* The quality of health care attracts the attention of patients, doctors and also medical insurance companies. The major factor for the assessment of health care quality was the lack of reliable and up-to-date information available to the patient-insuree and his doctor.

*Objective:* The objective of the IZIP system is to improve the health care quality provided to the patient.

*Methods:* The principal idea of the IZIP system is to transfer the medical database from the hands of health care professionals to the patient-insuree into the public information network – the Internet with guaranteed data security. In line with worldwide trend the team of authors have materialized their belief that when a patient goes to a medical office, the doctor should have a source of objective and reliable information about his provided health care. The IZIP system considers the patient as an active partner. A well-informed patient gains a better picture of the technical and even financial limitations of the proposed or available procedures and is able to make responsible decisions. He therefore cooperates better. The internet health files consist of selected parts of medical documentation. Only health care professionals may insert data and records into the IZIP system. In order to record data into IZIP, the physician uses his ambulatory software or information system in his office. Health care professionals may write into IZIP system through an interface which allows for data transmission from emergency rooms, laboratories, complementary services and pharmacies. Records in the IZIP system contain: Anamnesis, results of examinations performed by General Practitioner or Specialist in chronological order, results of laboratory tests and examinations, list of prescribed and issued medicaments, X-ray scans and other images, reports from hospitalizations, vaccination history, etc. Be that as it may the patient remains the owner of his health files which may only be accessed by himself or a designated health professional with his consent.

*Results:* Currently, system is used by 10% of the population. 40% of health care professionals and institutions are using and supporting the system. Number of clients (patients) with IZIP: 1,010,000; Number of records (uploads): 6,500,000; Number of healthcare professionals: 8,700; Number of healthcare institutions: 5,300. Individual accesses by healthcare professionals 63,000 per month to check patient data, by patients 110,000 per month, total number of transactions ca. 900,000 per month.

According to the study (eHealth Impact study) made by Empirica ([www.empirica.com](http://www.empirica.com)) the first year of annual net benefit was 2005, first year of cumulative benefit was 2006; estimated productivity gain 74%. Insurance companies are the main benefit receivers (53%), then followed by healthcare professionals (37%) and citizens (10%). Currently, there are several studies we are at IZIP working on. The most interesting study is done by an insurance company to find out real economic benefit on the group of diabetics. The results should be announced in autumn 2007.

*Conclusion:* The IZIP system was awarded (World Summit Award 2005) as the world's best e-Content in category of e-Health as only one of the European projects in a field. The award was presented on 16th November 2005 at the World Summit of WSIS Information Association in Tunisia. A year ago, in 2004, the IZIP system was chosen as one of the top 12 EIPA (European Institute of Public Administration) projects in the world. In 2006, IZIP won the Prize of Ministry of Informatics for the ICT society development. CACIO, the managers' association for information technologies field evaluated IZIP as Project of the year 2005.

## Partecipasalute website

P. Mosconi<sup>a</sup>, C. Colombo<sup>a,\*</sup> ([ccolombo@marionegri.it](mailto:ccolombo@marionegri.it)), S. Cima<sup>b</sup>, I. Moschetti<sup>c</sup>

<sup>a</sup>Mario Negri Institute Milan, Milan, Italy

<sup>b</sup>Zadig Milan, Milan, Italy

<sup>c</sup>Italian Cochrane Centre Milan, Milan, Italy

*Background:* In Italy there are several health-related websites disseminating reports or fresh news without any attempt to critically appraise the content nor to empower readers to evaluate its quality.

*Objective:* Mario Negri Institute, with the Italian Cochrane Centre and the medical journalist agency Zadig and supported by a charity foundation, launched in 2003 the project PartecipaSalute (Participate in Health Care) to foster a strategic alliance between patient groups and professional societies toward the goal of better health and shared decision-making [1].

An ad hoc website [www.partecipasalute.it](http://www.partecipasalute.it) has been developed with the aim to enable patients, consumers, their associations, and health care professionals to have an active participation in healthcare, critical appraise health information, and read health information from evidence based sources.

*Methods:* Its structure and design have been renewed on February 2007, after collecting comments from the readers about its usability. The home page is divided into three sections. The left one is composed by five chapters and ten columns: the former describe the project and its activities, give information on patients' rights and how to read health information critically, deal with rules and methods of clinical research, give a brief history of voluntary organizations in Italy; the latter deal with conflicts of interest in medicine, myths to disprove, uncertainty in medicine, shared decisions in health care, good websites and the evidence based message of the month, that reports the abstract sections of two EBM sources in Italian: Cochrane reviews and clinical evidence. The central section publishes the most interesting articles according to the editorial staff. The left section presents self-administered tools developed by researchers, journalists and advocates. Among them: the "MisuraTesti – Measuring texts", to evaluate the quality of medical information published by magazines and newspapers; the "MisuraSiti – Measuring websites", referring to literature instruments to test the quality of websites contents; and the "MisurAssociazioni – Measuring voluntary associations", to evaluate their credibility and quality.

*Results:* Between March 2006 and February 2007 the website registered monthly a mean of 15,750 single contacts and an average of over 200 people a month subscribed to receive the weekly newsletter. Every month the website receives about 40 comments and at least one new patients' association asks to be included in the ad hoc website database. We recently found out that searching through Italian Google engine the words "Incertezza medicina" ("Uncertainty medicine") PartecipaSalute is the first website popping out from about 350.000 pages reported (access 27 February 2007).

*Conclusion:* Among the PartecipaSalute project, the website is a fundamental instrument to convey to Italian advocates and scientific community the importance to strengthen the collaboration between each other and to promote critical and independent health information.

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## **Trial Item Manager: Towards an ontology based specification of items for clinical trials**

R. Mücke\* ([roland.muecke@imise.uni-leipzig.de](mailto:roland.muecke@imise.uni-leipzig.de))

IMISE, University of Leipzig, Leipzig, Germany

*Background:* One of the tasks to do, during the setup of a new clinical trial, is selecting and specifying the items to survey. This task is time consuming because a lot of items have to be assembled and a precise specification is not trivial [1]. One of the reasons is that people from different professions (e.g. biometricians, physicians, and database developers) work together and they have different points of view on trial items. Another reason is the lack of dedicated support for this complex task in current software tools. Although today's EDC systems allow to define items conveniently with graphical user interfaces and may access libraries of previously defined items, they are mainly directed to technical staff and require a lot of IT knowledge [2]. Furthermore they have limited capabilities to handle several variants of items that differ only in a few characteristics.

*Objective:* For this reason we are developing a software tool which is solely intended for creating precise specifications of trial items. This tool is called Trial Item Manager, or TIM for short. It offers great expressiveness to cover every single characteristic of an item and at the same time is easy to operate by non-technical users. This is achieved by presenting only those aspects of an item to the user that matter to him. With regard to the efficient handling of a plurality of variants of items and their reuse in other clinical trials main focus is laid on the search and browse capabilities of the application. Additionally, for a better vision of assembled items an automatic generation of draft views of CRF forms is available.

*Methods:* The Trial Item Manager is implemented as a web application. In this way it is possible to cooperate with distant project partners. The application is mainly based on Semantic Web technology. This allows one to specify items based on a well-founded ontology of clinical trials and their items. Furthermore it is the basis for a versatile usage of item specifications, e. g. for semi-automatic creation of databases, as libraries for EDC systems or for the preparation of data before statistical analysis.

*Results:* Currently, this software is under development. But it already showed that it is able to replace standard software (like Microsoft Excel) where no EDC software is available or suitable. Further on we observed that with the help of our tool not only the rank growth of variants of items can be controlled but also a harmonization of items can be achieved. Main reason for this is the fact that for a precise description of items the users are forced to make implicit information about items explicit. This information can be used for discussion among users and eventually merging of unnecessarily differing variants.

*Conclusion:* Our software is not intended as a direct competition with EDC systems but rather as a complementary tool which can make for a more efficient process of specifying trial items and by harmonizing items may increase the quality of clinical trials.

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## Internet help-seeking behaviour of male adolescents with mental health problems

R. Neuhaus Bühler\* ([rachel.neuhaus@bluewin.ch](mailto:rachel.neuhaus@bluewin.ch))  
Universitätskinderklinik Zürich, Zürich, Switzerland

*Background:* Research on help-seeking behaviour of adolescent's show that female adolescents seek and receive more help than male adolescents mainly for mental health problems [1,2]. Explanations for this gender difference focus on sex-typed behaviour. Help-seeking behaviour produces psychological costs that are inconsistent with traditional masculine sex-roles [3]. Internet may be a crucial tool for increasing the rate of help-seeking behaviour among adolescents [4–6] because the accessibility and the anonymity of the internet may decrease psychological costs. It is expected that male adolescents will benefit from the helping agent internet and in particular that the internet has the potential to reach male adolescents with mental health problems.

There are different ways to get help using the internet. For example it can be used to search for general information about a problem. Also using a health related professional online-consultancy service to get personalized information about a specific problem can be an effective strategy to get formal help for problems without loosing its own anonymity.

Annual reports of online-consultancy services and health information web-sites provide information on the quantity of visits, questions and content of questions. But the involved anonymity allows few references about the adolescent users.

*Objective:* To analyse how numerous male adolescents with depressive mood or suicidal thoughts search general health-related information in the internet or use health related online-consultancy services.

*Methods:* A self-report survey was completed by male adolescents ( $N = 307$ ) aged 14 through 18 years, enrolled in five different educational levels in Aargau, Switzerland. Internet related help-seeking behaviour for health related problems, depressive mood and suicidal thoughts were surveyed.

*Results:* 53% of male adolescents, use the internet to get general health related information ( $n = 162$ ) but just 5% already used an online-consultation service to get personalized health related information ( $n = 16$ ). Compared to adolescents who do not use the internet to get help, general information seekers and users of an online-consultancy service show significant higher depressive mood ( $F = 4.80$ ,  $df = 2$ ,  $p < 0.01$ ). Analysing just male adolescents with depressive mood disorder ( $n = 30$ ) only one person already used an online-consultancy service but 67% used internet to get health related general information. Likewise 61% of male adolescents with suicidal ideations ( $n = 82$ ) searched for health-related information and just 6% of them used an online-consultancy service.

*Conclusion:* Male adolescents with mental health problems use the internet to get health-related information but just a minority get in contact with a health professional through an online-consultancy service. Therefore, the internet has the potential to be an important prevention instrument for youth suicide and mental health problems of male adolescents but moreover through presenting information than offering contact with health professionals. Questions that still arise refer to the kind of information that really helps adolescents with mental health problems. How can information presented in the internet motivate them to get a treatment? And how do information sites and online-consultation services interact with suicidal adolescents? Those questions should be reflected with psychological and ethical perspectives.

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### **The contribution of different approaches of web-based consultation to the quality of care: Experiences of caregivers and care consumers**

N. Nijland\* (*n.nijland@gw.utwente.nl*), J.E.W.C. Van Gemert-Pijnen, F. Verhoeven, H. Boer, E. Seydel  
*University of Twente, Enschede, Netherlands*

*Background:* Currently, there are different approaches of web-based consultation, e.g., consulting a symptom driven digital triage system versus consulting a physician via free-text, and anonymous encounters versus encounters with a pre-existing relationship. It is interesting to explore how these new functions can be used and what their impact is on the quality of care. In this study we assessed the quality of different approaches of web-based consultation. Although there is not yet a widely-accepted method for evaluating the quality of e-health services, the field of quality-of-care measurement provided a solid foundation for understanding how to measure the quality of e-health services like web-based consultation [1,2].

*Objective:* To assess the contribution of web-based consultation systems to the quality of care; handling complaints from general health information to clinical problems.

*Methods:* We developed a framework for evaluation of healthcare services involving organizational aspects (health policy; transparency of guidelines), technology aspects (usability, convenience), communication aspects (patient-provider interaction), and self-care aspects. We used semi structured in-depth interviews ( $n = 30$ ) to identify critical incidents concerning the quality of care. Subsequently, we used scenario-based tests ( $n = 28$ ) to assess the rationale behind the incidents.

*Results:* Interviews revealed that consumers and caregivers experienced the systems as reliable and convenient. Consumers favoured interactions without a face-to-face contact and without a pre-existing relationship with a caregiver for relational and taboo complaints. Negatively reported incidents ( $n = 677$ ) referred to organizational aspects ( $n = 152$ ), usability ( $n = 207$ ) and convenience aspects ( $n = 34$ ), communication aspects ( $n = 61$ ), and self-care aspects ( $n = 223$ ). Current organization of health care hindered the incorporation of web-based consultation into daily practices. Regulations and guidelines for encouraging the dissemination of innovations and the inspection of the quality of the care delivery process were often not available or unclear about the user's rights and obligations. Moreover, an adequate infrastructure failed for education and training of end-users. Poor user-centeredness of the systems hampered self-management. Consumers wanted information tailored to their personal health situation, instead of information that is symptom-tailored. Scenario-based tests revealed that consumers appreciated free-text more than digital triage for general health information. Digital triage was preferred in case of clinical problems. It increased consumers' awareness of their health problems. On the other hand, free-text encouraged the expression of relational complaints.

*Conclusion:* It can be concluded that web-based consultation improved access to health care, but not yet the quality of care. The care delivery process by means of web-based consultation requires a communication structure sufficiently authoritative to clearly illustrate the indicators on which a modality of a technological solution can be chosen. Besides, the technology is not yet customized to users' needs. Consumers and caregivers seldom participate in the development and implementation of e-health services. Hence, the result is a technologically sound product, yet one that consumer and caregiver barely or never use. To enhance the quality of care web-based consultation, the needs of end-users should be the starting point for the development of those systems.

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## A personal reflection about if the health public systems must guarantee to citizens the electronic health's scope

V. Reyes-Alcázar\* ([victor.reyes@juntadeandalucia.es](mailto:victor.reyes@juntadeandalucia.es))  
 Agencia de Calidad Sanitaria de Andalucía, Sevilla, Spain

*Background:* In the last few years, the different healthcare administrations have been working in the application of the new information and communication technologies in their different healthcare scopes, unfolding multiple objectives including in their strategic plans. In all of them, the quality is conceived, in a more or less explicit way, like “the guarantee regarding health services that the public administration provide for citizens”.

*Objective:* Share a personal reflection with other professionals that work in the same topics. Moreover, suggest the creation of a MEDNET working group to define a set of elements that would have to be present in the healthcare websites, to satisfy the patients, citizens and healthcare professional needs (not focusing on the website's technological issues).

*Methods:* For more than one year, a healthcare professionals group from the Health Quality Agency, the Health Technology Assessment Agency and the Health Public School in Andalusia has been analyzing the international accreditation models for healthcare websites.

*Results:* It seems evident that this commitment for guarantee of the State and Local Governments is developed in a new framework for relations with the citizens, based on the customization and the transparency of the healthcare systems, and where the active participation of the patients and users through multiple channels has been facilitated by the new technologies. Internet has modified substantially the relationship scheme between different actors on the health process.

The new information channels used by citizens and the necessity to improve the access to the health information, mainly via Internet, would have to be considered for the different health administration levels about the obligation to offer guarantees in the use of Internet as a health information source, but not from a protective institutional approach, but on the contrary, from the recognition of the patient's reality and specially in the cases of those patients that assume an active role in the decision-making process that affects to their health.

This institutional guarantee for citizens in the scope of the electronic health, understood as access to trustworthy health information sources or to the health services providing online, derives from the initiative of the European Council eEurope 2002, for the elaboration of a basic set of quality criteria for health related websites.

Basically, there are four methods of implementing quality criteria in healthcare websites: 1. Simple Codes of Conduct, 2. Self Applied Code of Conduct or Quality Label, 3. User Guidance Tools and 4. Third Party Quality and Accreditation Labels.

*Conclusion:* The most advanced of the mechanisms available for implementing quality criteria for health related websites, is the third party accreditation system. A third party issues a label to certify the compliance of the site with the criteria of evaluation.

The Andalusian Health Regional Ministry has decided to develop a third party quality accreditation model and nowadays, the Healthcare Website Accreditation Programme of the Quality Health Agency is a reality.

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## Patient's safety at the Andalusian Public Healthcare System (APHS), Spain

V. Reyes-Alcázar\* (*victor.reyes@juntadeandalucia.es*), R. Carabaño Moral  
*Agencia de Calidad Sanitaria de Andalucía, Sevilla, Spain*

*Background:* Many developed countries have applied different models for the management of healthcare organizations. This fact was mainly influenced by political decisions, the development of information systems, increased citizen's expectations and models focussed on processes. All those changes produced a transformation in mentality, affecting both patients and decision-makers.

This paper describes the improvement of the patient's safety that is being implemented at the Andalusian Public Healthcare System (APHS), using the Accreditation Programmes for Healthcare Centres and Units. Andalusia is one of the largest regions located in the southern of Europe, with 7.2 millions of inhabitants.

*Objective:* To analyze the measures carried out by the different healthcare centres and units to improve the patient's safety and to avoid the appearance of adverse events.

*Methods:* Descriptive and cross-sectional study of the primary care centres and hospital specialized units that has been evaluated using the Accreditation Programme for Programmes for Healthcare Centres and Units. Participants: the Quality Health Agency of Andalusia analyzed 156 accreditation projects. 81 of them have completed successfully the accreditation process for healthcare centres. Interventions: In 156 accreditation projects, the Quality Health Agency gathered information regarding on the adverse events standards and also evaluated the identified actions by the healthcare centres and units to guarantee the fulfilment of those standards. Afterwards all those measures were grouped together to analyse them by a work team. The period of study was July 2003 to September 2006.

*Results:* The results were analyzed under two points of view. First, the registered type of adverse event and secondly, the initiated actions in the different primary care centres and hospital specialized units related to the adverse events. Regarding the recording type, four main categories were identified: (1) reactions or errors in the drugs administration (37.17%), (2) fall accidents record (26.17%), (3) biological accidents (20.94%) and (4) hospital infections (15.70%). Respect to the initiate actions in the primary care centres and hospital specialized units related to the adverse events 149 actions was identified, of which 53.7% are organizational actions, 21.4% preventive actions, 16.7% training actions and 8% assessment actions. Finally, based on the scope of the study (37 hospital units projects and 44 primary care projects), in 45.94% hospital projects and in 34.09% primary care projects there are a document that identifies the adverse events clearly.

*Conclusion:* The results analyzed shown that the Accreditation Programmes for Healthcare Centres and Units have helped to the Healthcare Centres and Units to focus attention on a very important problem: the patient's safety and the adverse events.

### **The consumers' perspective: Text features and readability of consumer health text**

G. Rosemblat\* ([rosem@nlm.nih.gov](mailto:rosem@nlm.nih.gov)), R. Logan  
National Library of Medicine, NIH, Bethesda, Maryland, USA

*Background:* The increasing number of consumers seeking health information online can foster a mismatch between the ability to understand written health information and the readability level of consumer health text [1,2]. Previous research [3] suggests that textual features (e.g.: discourse, style), significantly affect consumer understanding. In an earlier study [4], health communication experts identified textual factors that contribute to readability, such as the ability to convey the main point and consumers' familiarity with vocabularies.

The current study sought to compare these earlier assessments [4] with indirect measures of readability that consumers encountered with the same text [4]. The degree that consumer readability assessments were consistent with significant variables previously identified by experts was investigated [4].

*Objective:* This pilot study assessed how consumers evaluated the influence of specific linguistic and stylistic features on the perceived readability of health texts.

*Methods:* An external contractor conducted the study following an NLM-designed protocol, using a quasi-experimental, within-subjects design. Consumers ( $n = 48$ ) with diverse demographics and health literacy levels were recruited. Variables previously perceived as significant for readability [4] were reevaluated. Four identical passages used in [4] were reexamined: two with a lower and two with a higher readability score, as measured by an NLM-developed Readability Analyzer [3]. Several grounded instruments (E.g., Cloze test), were used to assess consumers' readability and comprehension, and convergence with earlier findings [4]. We sought to isolate the effects of vocabulary knowledge on performance, and measure how accurately participants perceived the main idea of each text. The Statistical Package for the Social Sciences (SPSS) was used to analyze the results.

*Results:* Vocabulary familiarity was positively and significantly correlated with Cloze test scores for the easy and difficult articles ( $r = 0.760, p < 0.000$ ;  $r = 0.680, p < 0.000$ ;  $r = 0.877, p < 0.000$ ). A significant relationship was found between the participants' educational level and term familiarity, easy article-Cloze and difficult article-Cloze measures ( $\rho = 0.811, 0.831, \text{ and } 0.758, p < 0.000$ , respectively).

There were no significant correlations between the perceived ability of the passages' authors to communicate the main point, and easy and difficult passages. However, moderate significance was found between Cloze scores and factual statements within difficult articles ( $\rho = 0.498, p < 0.01$ ).

*Conclusion:* In this study, vocabulary familiarity was also perceived as a significant contributor to readability, while author's ability to communicate the main point was not. The relationship between factual statements within difficult articles and poor Cloze scores allows us to draw the inference that the way vocabulary is used and elements are located in a passage influence readability assessments. Thus, this study also suggests that context of use is just as important as vocabulary familiarity: familiar terms used in unfamiliar ways (e.g., figurative uses) hinder readability. Overall, a consumer perspective contributes to an understanding of how vocabulary and main point contribute to readability.

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## The Italian Monitoring Centre for Pharmacological Clinical Trials: An effective Internet-based tool and source of information

M.E. Russo\* ([me.russo@aifa.gov.it](mailto:me.russo@aifa.gov.it))

Italian Ministry of Health – Medicines Agency (AIFA), Rome, Italy

*Background:* The Italian Monitoring Centre for Pharmacological Clinical Trials (Osservatorio Nazionale sulla Sperimentazione Clinica dei Medicinali) is a system for prospective clinical trial data registration, operational since 2000. The information is provided via web by the Sponsor of the clinical trial (pharmaceutical company and non commercial organisation) and Ethics Committee.

*Objective:* The system is a tool aiming at facilitating information interchange among the stakeholders (Sponsors, Ethics Committees, Regulatory Authorities, Investigators, potential clinical trial subjects, patients' associations).

*Methods:* Up to now it contains the information of more than 4,300 pharmacological clinical trials and it is managed by the Italian Medicines Agency (AIFA). More than 600 clinical studies have been performed every year on average; the distribution for phase is the following: Phase III 2,262 (52.3%), Phase II 1,515 (35.0%), Phase IV 384 (8.9%), Bioequivalence / Bioavailability 91 (2.1%) and Phase I 71 (1.6%) clinical studies. The total was 4,323.

*Results:* Many reports have been published during these years and all of them are available at the Osservatorio web-site (<http://oss-sper-clin.agenziafarmaco.it>). Since December 1st 2005 some information has become electronically searchable and available for public consultation at no charge.

Statistics on public consultation until May 2007 are the following: Total number of users was 3,218 with a total number of searches performed of 23,139. The average of searches for users was 7.

Users search strategies in the reference period have been performed according to the following figures: There were 12,149 (52.3%) searches by keyword, 8,253 (35.6%) searches by therapeutic area/ medial condition and 2,737 (11.8%) searches by geographic area.

*Conclusion:* The Italian Monitoring Centre for clinical trials provides a snapshot of Italian clinical research and is a leading instrument to promote the circulation of information relating clinical trials.

### **A hybrid, wireless and wired system for clinical data collection in the ECOSSED trial**

M. Sambo<sup>a,\*</sup>, V. Della Mea<sup>a</sup> ([dellamea@dimi.uniud.it](mailto:dellamea@dimi.uniud.it)), G. Della Rocca<sup>b</sup>, R. Sbrojavacca<sup>c</sup>, P. Viale<sup>b</sup>

<sup>a</sup>*Department of Maths & Computer Science, University of Udine, Italy*

<sup>b</sup>*Faculty of Medicine, University of Udine, Italy*

<sup>c</sup>*Department of Emergency, Udine City Hospital, Italy*

*Background:* The ECOSSED multicentric trial (Epidemiology, Clinical features and Outcome of Sepsis Syndrome observed in Emergency Departments) has been set up with the aim of obtaining insights on the issues regarding sepsis management [1]. In fact, sepsis still has a relatively high prevalence that is not fully explained. Furthermore, mortality in severe sepsis ranges from 25 to 56% [2,3], due mainly to therapeutical delays. ECOSSED has multiple aims: i) an epidemiological study of the sepsis event in the community, and also ii) of the outcome; iii) an assessment of the level of knowledge on sepsis among emergency personnel; iv) eventually, definition of extra severity scoring methods.

*Objective:* With the aim of supporting the clinical trial, a system has been designed and implemented for collecting clinical data in Emergency departments. According to the clinicians needs, an hybrid system has been developed able to support data input either on mobile devices (i.e., PDAs) and desktop computers. Furthermore, alla data are gathered in a common server accessible to data managers and the trial' principal investigator. The system had to be robust to communication problems, safe, and easy to use.

*Methods:* Three scenarios have been described to choose an architecture for the system: among those, one satisfied the above described criteria, and thus has been selected for the implementation. In this scenario, PDAs are the main input device; data collected on the PDA during the day are sent to one of the desktop computers available in the department using Bluetooth. On the desktop computer data can be completed if needed, and then sent to a central server through a web service based protocol. A first test has been made in the Emergency department of the Udine City Hospital, involving 16 medical doctors sharing three PDAs and three desktop computers.

*Results:* Microsoft.Net has been chosen as development framework for the client applications, while the central server application has been developed using PHP and MySQL. Three applications have been developed: ECOSSED Mobile and ECOSSED Desktop, respectively for PDA and desktop computer, and ECOSSED server. An additional software (ECOSSED utility) has been developed to configure each other application whene installed in a new department. Data are exchanged from PDA to desktop using Bluetooth in the form of an XML file; the same file is then transferred through web services to the central server, where a web interface allows data managers to add further data related to patient' follow up. On the PDA application, writing has been reduced to the minimum.

*Conclusion:* Though preliminary, first results demonstrated that doctors appreciated the system. As writing on the PDA is difficult, the desktop application is often used to complete data previously inserted with the PDA. After the end of the trial, a revised version of the system could be used to support decision in determining where the patient has sepsis or not.

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## e-Health vs e-Government

J. Sarivougioukas<sup>a,\*</sup> ([jcsari@ath.forthnet.gr](mailto:jcsari@ath.forthnet.gr)), A. Vagelatos<sup>b</sup>

<sup>a</sup>“G. Gennimatas” General Hospital, Athens, Greece

<sup>b</sup>RA Computer Technology Institute, Patras, Greece

*Background:* eGovernment has been defined as the use of Information and Communication Technology (ICT), and particularly over the Internet, to achieve better government (OECD, 2003). On the other hand, eGovernment is not simply the process of interpreting the available procedural functions on an electronic platform. Rather, it calls, today, for rethinking the way, the government functions to improve some process, to introduce new ones and to replace others.

*Objective:* The objective of this study is to identify the possible differences as well as similarities or overlappings of e-health and e-government.

*Methods:* eHealth tools or solutions include products, systems and services that go beyond simply Internet-based applications. They include tools for both health authorities and professionals as well as personalised health systems for patients and citizens. Examples include health information networks, electronic health records, telemedicine services, personal wearable and portable communicable systems, health portals, and many other information and communication technology-based tools assisting prevention, diagnosis, treatment, health monitoring, and lifestyle management.

*Results:* But which is the connection between e-health and e-government?

- eHealth is a major component of eGovernment
- eGovernment without eHealth is not complete
- eHealth is global
- eHealth is a superset of eGovernment users, applications and processes
- eGovernment needs accurate and usable information from eHealth
- eHealth needs to be mainstream (in line with eGovernment)
- eGovernment should set the scene for infrastructure, policy, cross borders and top level requirements,
- eHealth needs the discipline, standards, good practice and scale from eGovernment.
- eHealth & eGovernment working together will secure broader industrial investment

*Conclusion:* Standards and regulations compose the rules for the successful application of eHealth as they are enforced to be obeyed by eGovernment. The eGovernmental rules are dictated by eHealth while it is trying to obtain continuous improvements to the quality of well-being.

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### **GCPBASE: A web-based tool for remote data capture in a clinical trial**

E. Santoro\* (*eugenio@marionegri.it*), L. Clivio, S. Mangano  
“Mario Negri” Institute for Pharmacological Research, Milan, Italy

*Background:* Electronic Case Report Form (e-CRF) Systems represent powerful tools for remote data capture in clinical trials [1]. They allow to strongly reduce time for data entry and management, and to facilitate data and centers monitoring [2]. Many e-CRF systems are available today but they are often too complicated when handling simpler clinical trials.

*Objective:* To develop a general data entry engine for clinical trials with a user-friendly interface for investigators but respecting a strict compliance with the requirements of current national and international laws concerning data protections, ethical and regulatory issues. Moreover the system has to be used with or without an Internet connection.

*Methods:* Data is stored in an enhanced version of the Entity-Attribute-Value (EAV) data model [3] that can easily be adapted to a generic clinical database schema. The system has been developed as a web application with J2EE technology. A special framework has been developed in order to use an instance of the software as a stand alone application installed on a local environment when an Internet connection is not available. Used in this way, a data synchronisation engine allows to keep the centralised and the local databases up-to-date. Data interchange procedures have also been developed to import/export record from/to MS Excel and SAS environments.

*Results:* We have developed a general web-based multi-form handler, called GCPBASE. In order to start a new study the investigator is required to design the CRF pages using a html editor and to specify the items to be collected. These items are used to properly fit the EAV model with the database schema, and to create a standard web-based user’s interface including commands for user authentication and for operating with the database. All developed software is released as free software under the General Public Licence.

*Conclusion:* GCPBASE has been internally developed as a solution for non-registrative phase II, III and IV clinical trials. A first version of GCPBASE has been used in the last 5 years at the “Mario Negri” Institute for Pharmacological Research to handle about 30 cancer clinical studies for a total of 7500 patients. We think it could be a feasible and free of charge alternative to commercial tools for the conduction of simple and not too large clinical trials or observational studies.

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## **Market competition and the effects of interactive patient information programs: Experience with Emmi™ at the University Medical Hospital Hamburg Eppendorf**

C. Schmitz<sup>a</sup> (*c.schmitz@uke.uni-hamburg.de*), R. Sturm<sup>b</sup>

<sup>a</sup>University Medical Hospital Hamburg Eppendorf, Hamburg, Germany

<sup>b</sup>QB International GmbH, Berlin, Germany

*Background:* University hospitals are facing rising competition from specialized clinics, private ambulatory practices and other full service hospitals. Since patients have become more mobile and less brand loyal, innovative approaches to gain the loyalty of patients and referring doctors are necessary.

*Objective:* Emmi (Expectation Management and Medical Information) was developed in the USA by Emmi Solutions, LLC, and has been used by leading hospitals and health care funds since 2003 to manage patient expectations, help patients prepare for and recover from medical procedures and promote healthy behavior. Emmi presents medical information on chronic conditions and surgery (using illustrations, sound and text) in an easy to understand, conversational, comforting manner.

*Methods:* The University Medical Hospital of Hamburg-Eppendorf (UKE) has implemented Emmi in a modified way, taking account of strict data protection regulations and specific organizational circumstances.

*Results:* Emmi streamlines the care process. The process of informed consent starts at home via the internet. Prior to the patient's first examination in the clinic, a referring doctor can provide the patient with access to the Emmi program. Emmi encourages the patient to input any comments or questions he may have which are then discussed with the doctor upon admission. After surgery, patients can be sent multiple messages electronically from the time of discharge to months later, delivering the right information at the right time for optimal success. The World Health Organization concluded in 2003 that in developed countries only 50% of chronically ill patients follow their doctors' prescriptions. At UKE, Emmi will improve patient understanding and patient care, foster compliance and lead to better medical outcomes. Patients are increasingly likely to sue if they suspect a treatment error.

Malpractice claims – even when unjustified – strain the resources of management and physicians and can damage the reputations of institutions and staff. Two thirds of patients who have viewed Emmi in the US confirm that they are more apt to recommend their doctors. 88% of the patients felt more comfortable about their procedure having viewed Emmi. The effect of Emmi on patient satisfaction at the UKE would appear to reflect the favourable US experience and will be documented by a patient survey. At the UKE, doctors in private practices will provide patients access to the Emmi system to view at home. These eye doctors will thus be able to provide a better service to their patients than their competition. Emmi documents what the patient views, and this can be used in support of the doctor in the event of a malpractice suit, thus reducing damage claims and insurance premiums over time.

*Conclusion:* For UKE, Emmi will result in a long-term and predictable stream of referrals. The Emmi program is co-branded with the UKE logo which fosters the university's reputation for innovation and quality. Emmi will be included as a quality standard in its cooperation agreements with referring doctors. Emmi will thus provide a competitive advantage to the UKE, securing the loyalty of referring doctors and fostering the long term success of the hospital.

## Business models for grid computing in life sciences: An approach to identify health grids revenues

S. Scholz<sup>b,\*</sup> ([stefan-scholz@tmf-ev.de](mailto:stefan-scholz@tmf-ev.de)), M. Blaurock<sup>b</sup>, M. Breitner<sup>a</sup>, S. Semler<sup>b</sup>

<sup>a</sup>Leibniz-Universität Hannover, Hannover, Germany

<sup>b</sup>TMF Telematikplattform für medizinische Netze e.V., Berlin, Germany

*Background:* Grid computing is one of the emerging research areas of modern telematic life sciences. However, little is done in this field with regard to the development of business models and, in particular, revenue schemes. Main efforts have been mainly concentrated on billing and accounting issues or have focused on the efficient allocation of resources. A profound discussion on generic revenue models in health grids is still missing in the academic literature.

*Objective:* The presentation aims to provide a first approach to sustainable revenue models in health grids. Besides a discussion of applicable revenue models mapped on different activity models, i.e. groups of products and services offered within a health grid structure, we want to give a rough estimate of grid economics by evaluating two concrete business cases based on the BMBF D-GRiD initiative's MediGRID project.

*Methods:* Among other aspects, our approach is based on three sources. First of all, we focus on profound literature research, including recent results extracted from the MediGRID project. Secondly, we consider several interviews with experts within the (health)grid community and abroad, and finally, we will implement a basic calculation model running on Microsoft Excel. In order to understand and develop viable revenue models we will identify critical success factors involved, modify established revenue schemes of the life science sector and link them with revenue approaches identified in the e-business world.

*Results:* The results will show that, despite current objection against business applicability of grid structures in life sciences and medicine, certain models might be successful in generating revenues in health grids. These results will be underlined by estimates extracted from two business cases based on application classes and services offered by MediGRID. Findings and expertise from the e-learning sector will be incorporated in our research, especially with regard to the migration process from public finance to market acceptance. However, we stress several challenges, risks and the need for changes in structures and in the way of thinking in order to realize these revenues, especially in a German health system driven environment.

*Conclusion:* The influence of grid technology will significantly change an established business environment in life science in the next years. Selected e-business revenue approaches based on certain customer acceptance models are applicable to life science activities in grids, either applications or supporting services. However, the special character of the life science sector, especially in Germany, its mechanisms and its specific success factors have to be taken into account seriously, since these facts may be critical in establishing sustainable business solutions.

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### **Introducing new telemedical services into clinical environments – A step-by-step approach at the University of Leipzig**

C. Standke<sup>a</sup> ([christian.standke@campusinform.de](mailto:christian.standke@campusinform.de)), G. Hindricks<sup>c</sup>, D. Häckl<sup>b</sup>

<sup>a</sup>*Campus Inform group at the University of Leipzig, Leipzig, Germany*

<sup>b</sup>*Leipzig Graduate School of Management (HHL), Leipzig, Germany*

<sup>c</sup>*Heart Center Leipzig at the University of Leipzig, Leipzig, Germany*

*Background:* Modern clinical environments need good networking structures to interact with admitting colleagues and patients. Synchronous and asynchronous Telemedicine Services seem to be ideal for this task. Telemedicine Services can automate certain parts of information requests and can highly speed up clinician to clinician and clinician to patient communication. Introducing these services into a given environment needs vast infrastructural, logistic and legal considerations. To predict the clinical workflow impact and needs in personal and hardware infrastructure, prototypic “environment-test” solutions seem to be desirable.

*Objective:* To predict the clinical workflow impact and needs in personal and hardware infrastructure, prototypic “environment-test” solutions seem to be desirable.

*Methods:* For the Heart Center Leipzig a complex step-by-step plan for different clinical communication services was developed: A central website serves as communication portal and can be reached via internet/intranet. In the first approach the website is equipped with simple clinical and scientific information in HTML and PDF-Format. With this first approach also single user-restricted telemedical services are introduced to a restricted number of external clinicians. One of those is a web- and faxbased rhythmologic consultation service. The service utilizes the network capabilities of the internet and of the common telecommunication network. This way information input can be achieved either by using a browser/email-client or by using a fax machine. Further the complete concept integrates the development of personnel skills via workshop training to ensure proper handling of the introduced tools.

*Results:* A prototype of the website and the prototypic communication architecture for fax/email have been established and are in use with 15 local and 112 worldwide users. For 90 persons at the Heart Center Leipzig a workshop for the development of “telemedical skills” could be held and a personnel evaluation could be done successfully. An in-house email-communication could be introduced in parts and is in use for internal communication. For business management and legal aspects, vast logistic flowcharts and contract models for telecommunication and teleservices in Germany could be developed.

*Conclusion:* The platform provides a first step to a network for fast and easy communication between specific medical interest groups. The prototypical rhythmologic service allows easy teleconsultation

and discussion on ecgs and rhyhmologic questions between the Heart Center Leipzig and rhythmologic experts and non-experts. Due to the use of web- and fax-based technology, the access to the service is easy and does not require PC-equipment or a scanner. For the future the whole concept allows easy environment beta-testing, personnel skills training and concept-roll-out to other telemedical services of the Heart Center Leipzig.

### **Sharing cardiology cases with students and doctors over the WWW: The Kasus-Platform at the Heart Center Leipzig**

C. Standke<sup>a,\*</sup> ([christian.standke@campusinformatik.de](mailto:christian.standke@campusinformatik.de)), A. Wolf<sup>b</sup>, H. Kottkamp<sup>c</sup>, Ch. Elsner<sup>d</sup>

<sup>a</sup>*Campus Inform group at the University of Leipzig, Leipzig, Germany*

<sup>b</sup>*University of Munich, Ophthalmology Department, Munich, Germany*

<sup>c</sup>*Heart Center Leipzig at the University of Leipzig, Leipzig, Germany*

<sup>d</sup>*Leipzig Graduate School of Management (HHL), Leipzig, Germany*

*Background:* Beside regular seminars the department for Internal Medicine at the Heart Center Leipzig uses Bedside-Teaching and Problem-Oriented Learning (POL) to teach medical students. The advantages of those teaching methods consist in their ability to foster active student inquiry and critical thinking. To have the chance to record interesting cases and reuse them for later seminars and case-presentations, the department uses the PC/WWW-Platform KASUS (Elsner et al.). Acquiring a case and implementing it into the KASUS database for future use is achieved with a simple system consisting of a palmcomputer and a digital camera. Sharing the cases with other groups learning in the POL-format is possible with the KASUS ONLINE application and the WWW-based “Studentencafe”, which allows students and doctors to share and discuss cases in different forums.

*Methods:* The Platform consists of two modules. One module is intended for case presentation and case-workup. A second module is intended for case material sharing and case-related information exchange. Both modules use static/dynamic HTML and can be used local or over a TCP/IP network. For the case acquirement a normal Palm Pilot II & a digital camera or existing interfaces to patient-data were used.

*Results:* Material for single cases could be acquired and the material could be presented in seminars successfully. The Palm Pilot II performed good, but showed not to be fast enough to type in the case material. For digital case-documentation and the adequate case-authoring for POL-groups guidelines were put up. A small library with Acrobat Reader Files linked e.g. with recorded heart/lung sounds was collected for modular use with the system. The “Studentencafe” was launched in the internet. Existing POL groups at the University of Leipzig and the FU Berlin started using this module for information exchange and serve as content providers.

*Conclusion:* With the Kasus-System case documentation and implementation in a case database is fast and effective. The advantages of the established platform lie in its utilization of the universal accessibility and network capabilities of the WWW. The use of an Internet web-browser interface provides platform-independent access and the opportunity to share and discuss case information from different remote locations. We believe that those applications can support POL groups in establishing intensive communication and can supplement their traditional POL learning approach by using the internet-support. Cases can be exchanged more easily, including complex multimedia case-related data. Facilitated information exchange on an inter-university level offers an opportunity to discuss with students and doctors coming from different backgrounds.

## Biomedical data mining for the Greek language

A. Vagelatos<sup>a,\*</sup> ([vagelat@cti.gr](mailto:vagelat@cti.gr)), E. Mantzari<sup>b</sup>, G. Oprhanos<sup>b</sup>, C. Tsalidis<sup>b</sup>, M. Pantazara<sup>b</sup>, C. Kalamara<sup>c</sup>, C. Diolis<sup>a</sup>

<sup>a</sup>RA Computer Technology Institute, Patras, Greece

<sup>b</sup>Neurosoft S.A., Athens, Greece

<sup>c</sup>Athens' "Euroclinic", Athens, Greece

**Background:** Natural Language Processing (NLP) has been applied to biomedical text for decades, in fact, soon after computerized clinical record systems were introduced in the mid 1960s. In recent years, research has continued to focus on text indexing and document coding to allow powerful and meaningful retrieval of documents. Document indexing uses terms from a glossary or ontology (MeSH, Gene Ontology, Galen4) or text features such as words or phrases. Most NLP systems in clinical medicine work with text from patient records such as discharge summaries and diagnosis reports. NLP systems in bioinformatics use mostly articles or abstracts from the scientific medical literature.

**Objective:** The expected output of the project "Iatrolexi" ([www.iatrolexi.gr](http://www.iatrolexi.gr)) are tools that address directly the final user of the biomedical information, such as a spelling checker of Greek medical terms, and also tools that will mainly assist processing of the Greek biomedical texts and improve search and retrieval of biomedical data, such as a tagger for morphosyntactic annotation appropriately tuned to the particularities of the biomedical sublanguage and an ontology of the Greek biomedical terminology.

**Methods:** The project aims at the creation of the critical infrastructure for the Greek language which will constitute the groundwork for advanced NLP applications in the domain of biomedicine, i.e. text indexing, information extraction and retrieval, data mining, question answering systems, etc. To accomplish this, a number of essential tools and resources are under construction for the Greek language that will allow better management and processing of the digitally encoded information in the biomedical field.

**Results:** The project is at the mid of its duration. Until now, a) a Greek biomedical corpus has been collected, b) the initial top-level taxonomy has been implemented, which is the first step for the ontology construction, c) the collection of biomedical terms from the corpus has been completed and the terms have been incorporated included in the already developed Greek morphological lexicon. Additionally a number of tools have been implemented (a crawler, a morphosyntactic tagger, a noun phrase chunker) to support the whole process. Till the end of the project, the biomedical ontology remains to be fully developed as well as a number of applications that will use the abovementioned infrastructure (ontology browser, spelling checker, intelligent search engine).

**Conclusion:** NLP infrastructure is a key element in the further development of informatics applications in several areas, such as data mining, knowledge-based decision support, terminology management, and systems interoperability and integration. A significant body of work now exists that report on experiences with various approaches in important problem areas of research. On the contrary in the biomedical field and especially for the Greek language, there is not much work implemented. Project "Iatrolexi" aims to cover this certain gap by developing a number of NLP resources as well as application for the scientific community.

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### **Madonna – A Web based, patient centred, protocol driven, interhospital collaboration project for women’s health using an interactive intelligent web portal**

J.W. Van der Slikke\* ([vdslikke@knmg.nl](mailto:vdslikke@knmg.nl)), P. Kenemans

*Department Obstetrics & Gynaecology, VU University Medical Center, Amsterdam, Netherlands*

*Background:* The project originated on the work floor, mainly from the dissatisfaction of gynaecologists and their patients with the current diagnostics and therapeutic state of affairs in the health care chain. Madonna is symbolic for “mother and child”, but also for the “emancipated woman of today”. The most important characteristics of Madonna are:

- The patient is the focal point (demand-based health care, the care chain is reversed).
- Optimal care takes place within a regional network of co-operating hospitals (transmural Diagnosis Treatment Protocol and Electronic Records are then necessary elements).
- The designed care paths are based on existing treatment protocols (‘evidence-based health care’).

Demand-based health care with the use of ICT applications and services is still rarely used. Madonna is based on an intelligent, interactive front office (the Madonna portal), linked to various back offices. The initiative was taken by gynaecologists from the VU Medical Centre and the St Lucas Andreas Hospital in Amsterdam-West, with the strong support of the boards of directors of both hospital.

*Objective:* The aim of the Madonna Program is to develop and realize a more efficient and cost-saving system of health care with the aid of ICT applications and -services for both the citizen and the patient in the field of obstetrics and gynaecology (in the Amsterdam-West region).

*Methods:* On the basis of a number of preliminary studies, a concept for integrated regional health care was developed, a number of elements of which have already been partly implemented. The ICT services concept will be further developed within the Madonna Program, whereby the patient logistics within the region will be further streamlined. By making use in an innovative manner of ICT, work is on-going on the creation of a single virtual “front office”, in the form of an interactive intelligent web portal that provides access to health care in Amsterdam West. Via this web portal both the client (citizen or patient) and the professional (such as the family doctor and midwife) can find answers to questions. Triage and referral can take place in the domain of Women’s Health. The portal allows information to be obtained via digital interaction and an appointment can be made directly with the right specialised outpatients clinic. Moreover the patient creates her own electronic record. The data only have to be recorded unambiguously once, and the data can be accessed at all times by all medical staff concerned and by the patient, independently of the time and the location of the patient.

Hereby attention will be paid specifically to the highest national standards for security, identification and authorization.

*Results:* The Madonna Program is expected to lead, to shorter waiting times, short treatment trajectories, a reduction in the costs of health care and a more rapid return to work for those people involved in employment. This was confirmed by means of a simulation study conducted by TU Delft. Simplified collaboration between regional hospitals must lead to a better division of tasks on the basis of available expertise and health care capacity.

*Conclusion:* The program should lead to the development of new standards (for ICT and logistics) and to a new, healthy financing model for health care chains using ICT. The ultimate goal of Madonna is to optimize patient logistics and knowledge management, with the aim of achieving affordable, but high quality patient care, education, training and research.

### **Self-management of self-limiting diseases via a web-based communication system for digital triage in Primary Care**

J.E.W.C. Van Gemert-Pijnen<sup>a,\*</sup> (*j.vangemert-pijnen@gw.utwente.nl*), K. Cranen<sup>b</sup>, S.S.F. Verlinden<sup>c</sup>, H. Boer<sup>a</sup>, N. Nijland<sup>a</sup>, F. Verhoeven<sup>a</sup>, E.R. Seydel<sup>a</sup>

<sup>a</sup>*University of Twente, Enschede, Netherlands*

<sup>b</sup>*Roessingh Research & Development, Institute for Research in Rehabilitation Medicine and Technology, Enschede, Netherlands*

<sup>c</sup>*Vivici Bv, Leiden, Netherlands*

*Background:* Previous studies demonstrated that health care consumers favor web-based communication systems to control their own care [1]. For these self-management services to succeed, web-based communication systems have to be tailored to the diversity of health consumers' needs. The web-based communication system used encrypted software for secure exchange of information. Users had to log on with a user-ID password. The system required a pre-existing relationship between care consumers and caregivers, and was therefore a system with type B interactions (Bona fide relationship [2]). The system offered the following types of facilities to care consumers: a) general health information via online brochures, b) a symptom driven digital triage system for self-care, that consisted of a dynamic questioning-and answering system. The digital triage system provided a self-care advice; it can be seen as a "computer consult", c) a digital triage system combined with free-text (e-mail) to communicate with a GP (e-mail consult). In this paper we evaluated the digital triage system, or "computer consult" (b).

The symptom driven triage system (ISO 9000:2000 standards; certified TNO-QMIC) was developed with 25 'entry' complaints based on the criteria: high frequency, no physical contact required to assess medical situation, and the possibility to rule out emergencies. Each complaint leads to a specific triage module. Information required to assess the specific health situation was gathered through a dynamic questionnaire, varying on gender, age, and answers on previous questions. Upon completion, the expert system assesses the urgency of the current health situation and provides an advice.

The consumers received an online form (computer generated) with a diagnose and an advice, based on the information gathered through the health compliant related questions-and-answers, and varying from "contact a doctor immediately" to a tailored self-care advice. We examined the compliance with care advices provided via the expert system, e.g., the digital triage part of the system.

*Objective:* To empower health consumers to control their health behavior and to facilitate primary care practice.

*Methods:* The frequencies of various complaints and the types of advice provided by the system were examined (during 15 months, 2005) via retrospective analysis of complaints entered by 6,540 consumers. To determine factors influencing compliance with self-care advice a theory-based online survey ( $n = 192$ ) was carried out presented at the website. A follow-up questionnaire ( $n = 35$ ) was used for assessing the actual compliance with the advice (3 months period, 2006).

*Results:* Of the 6,540 consumers who started a digital consult, 59% ( $n = 3785$ ) completed it and received a care advice. The frequency of the clinical problems presented most was: cough (22.4%,  $n =$

848), dermatitis (13.9%,  $n = 526$ ), urinary complaints (11.6%,  $n = 439$ ), diarrhea (9.8%,  $n = 371$ ) and headache (8%,  $n = 303$ ). In 14% ( $n = 543$ ) of cases, a fully automated problem tailored self-care advice was provided. The vast majority (86%) received an advice to contact a doctor; within 24 hours (51%), 17% within 4 hours, and 14% within 1 hour. The attitude ( $p < 0.001$ ) towards the provided advice, the experienced confidence in the advice ( $p < 0.001$ ), and the judgment about the effectiveness of the provided advice ( $p < 0.001$ ) appeared to be significant predictors (predictive power 55%) of the intention to follow-up the advice. It appeared from the follow-up questionnaire that 57% of the 35 respondents actually complied with the given advice. Education ( $p < 0.01$ ), medication use ( $p < 0.05$ ), pre-existing plans to act on the advice ( $p < 0.001$ ), correspondence between expected and received advice ( $p < 0.001$ ) significantly influenced compliance.

**Conclusion:** Digital triage promotes self-management of self-limiting diseases especially for chronic care patients, and consumers who have confidence in computer-generated advice and who planned to act on the advice. Therefore, web-based consultation can contribute to a more efficient primary care system, it facilitates the gatekeepers' function. To promote web-based communication, further research is needed about factors that influence the efficiency and effectiveness of digital triage related to (non)compliance.

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## The reach and use of an online healthy lifestyle program for pregnant women

M. Van Zutphen\* ([moniek.van.zutphen@rivm.nl](mailto:moniek.van.zutphen@rivm.nl)), I.E.J. Milder, W.J.E. Bemelmans  
*National Institute for Public Health and the Environment (RIVM), Bilthoven, The Netherlands*

**Background:** Lifestyle counselling in an early stage of life may prevent many health related problems later. Therefore the Dutch Ministry of Health initiated an internet-based healthy lifestyle program that is offered to all pregnant women.

**Objective:** The aim of this pilot study was to assess the reach and use of an online healthy lifestyle program for pregnant women.

**Methods:** During March to August 2006, 1382 pregnant women visiting 25 midwifery practices in Amsterdam were invited to enroll in the program through registration on the program website. Pregnant women who heard of the website through other channels could also enroll. After completing a short questionnaire, participants received an email every four weeks, tailored to the stage of pregnancy. The emails provided interactive questions, including answers, on six lifestyle topics and links to appropriate websites. Program reach was assessed of the midwifery visitors only, as the number of website registrations and the number of participants who continued to use the program throughout their pregnancy. Measures of program use included: opened lifestyle topics and related websites visited.

**Results:** 17% (238/1382) of the women who received information through their midwife enrolled. Highly educated women (68%) and women with a healthy lifestyle were overrepresented compared to the target population. 52% (120/238) of the participants continued to use the program throughout their

pregnancy. So 9% (120/1382) of invited women was reached sustainably with lifestyle information. This group accessed on average 4 emails, 20 questions and 3 related websites and the six lifestyle topics were accessed in more or less equal numbers. Sustained use of the program was associated with education level, women with a low education level were less likely to continue to use the program compared to highly educated women (45 vs. 63%).

*Conclusion:* This pilot study showed that the program in itself could be implemented and used under real-life situations. However, only half of the midwifery practices would like to continue encouraging pregnant women to enroll in the internet-based healthy lifestyle program. Moreover only 9% of those invited was reached sustainably and there was selective enrollment and in addition to that selective retention. Therefore more effort is needed, and will be done, to reach more disadvantaged women now the program is nationally implemented ([www.hallowereid.nl](http://www.hallowereid.nl)). Besides assessing the reach of the program it is also necessary to study the effects on behavior to be able to determine the possible impact of the program on public health.

### **Mobility in medical environment: An experience report from Teaching Hospital Na Bulovce**

J. Veclik<sup>a,\*</sup> (contact: [stanislava.bartova@izip.cz](mailto:stanislava.bartova@izip.cz)), P. Vasko<sup>b</sup>, M. Svoboda<sup>c</sup>

<sup>a</sup>IZIP Incorporation, Na Bulovce, Prague, Czech Republic

<sup>b</sup>Teaching Hospital Na Bulovce, Czech Republic

<sup>c</sup>Intel, Prague, Czech Republic

*Background:* Neurological department of Teaching Hospital Na Bulovce, Prague disposes as medical and speciality department of unusual geographical structure. The organisation of the department – Intensive Care Unit, Bed Unit, Exam-, Admitting-, Administration- and Nurses rooms are on very long distances which makes daily routine more difficult than it is typical. For this purpose the head of department decided to use and utilize modern devices to support and improve routine operation at the department.

*Objective:* The main aim of this pilot project was to supply the Neurological department at Teaching Hospital Na Bulovce by wireless equipment, to develop and modify such devices which are friendly to user oriented and makes life of everyday medical routine easier. The second objective was observation and track of the improvements to consider other departments to run on the same technologies.

*Methods:* Consortium of pilot project participants are mostly vendors of ICT devices and technology providers. They commonly agreed upon development of such device which match with medical staff needs and requests. For this purpose the extended survey was done to identify needs to design acceptable solution according to.

*Results:* Currently medical staff is using Computer tablet PC P1510 (by Fujitsu Siemens, Intel) of A5 format with weight not exceeding one kilogram. The weight and the format are revolutionary compared to equipment available on the market and with the same functionalities and parameters. The tablet enables medical staff to have internet connection and browse for the information needed in real time (WI-FI) or connect to the local hospital network or into the hospital information system. It is possible to search or view x-ray, CT, MRI scans, medical exam results, search in EHR (by IZIP, operation around the whole country) and view patient previous examination and right away update patient medical data in. Data transfer security is assured by several protecting elements like passwords, biometric elements and other codes necessary in order to access any of these systems. The tablet by its function does not disturb in operation other medical machines eg. ventilators, EKG etc. which are usually very sensitive and easily disturbed by other waves.

*Conclusion:* Pilot project proved significant time saving on the side of medical staff. The tablet enables them to type reports right away while patient is examined. Patients highly appreciate more time medical staff is spending with them. There has been remarkable communication improvement between medical staff and patient. Patients feel very comfortable and more active in treatment process, because medical staff can show them the examination results, scans etc. and explain them in a minute what is needed. Other hospital departments and even whole hospitals are interested in having these devices available for their medical staff, too.

Several hospitals in Czech Republic already expressed their interest to implement the PC-tablets on their departments. Most of the entities are waiting for the open calls by Ministry of Health, which has allocated remarkable financial sources for upcoming structural funds season. The main purpose is support of extended and advanced usage of ICT in hospitals with aim to provide best services in modern well equipped hospitals. Medical professionals experienced with this pilot project are “voluntarily” helping with training and having oral presentations on national level to broaden up the knowledge and necessity of advanced ICT usage. Positive examples always lead and bring to the attention other partners. From industrial point of view, this pilot project and enormous interest of other hospitals in friendly oriented ICT forces industry to reconsider development strategy as well as communication with medical professionals.

### **MediGrid – Practical implementation of ontology-based sharing of biomedical knowledge**

J. Vejvalka<sup>a,\*</sup> ([jan.vejvalka@lfmotol.cuni.cz](mailto:jan.vejvalka@lfmotol.cuni.cz)), P. Lesny<sup>a</sup>, K. Slabý<sup>a</sup>, A. Jarolímková<sup>b</sup>, T. Holeček<sup>c</sup>

<sup>a</sup>*Motol Faculty Hospital, Prague, Czech Republic*

<sup>b</sup>*CESNET, Czech Republic*

<sup>c</sup>*School of Humanities at Charles University, Prague, Czech Republic*

*Background:* Ontologies and classifications, such as UMLS, MeSH, On9 or GO, usually consist of large thesauri of biomedical concepts and sets of their relations. In most of the ontologies, relations between concepts or their groups are mostly taxonomical (*is\_a*) and meronymical (*part\_of*); the UMLS semantic network, however, recognizes more than hundred of these relations.

Medicine and especially algorithmic medicine usually deals with more complicated problems than those which can be expressed using a fixed set of relationships between concepts. The link between biomedical ontologies and pragmatic problems as they are addressed e.g. by algorithmic medicine remains unsolved.

*Objective:* Based on extensive research and on our previous work, we have postulated the basis of MediGrid, the working tool for sharing knowledge resources by analyzing complex (usually implicit) biomedical ontologies in medical algorithms and by realizing (and practically implementing) their potential for data processing.

*Methods:* The key principles of MediGrid can be expressed as follows: 1. data processed by biomedical algorithms are described (in accord with the philosophical tradition of phenomenology represented e.g. by E. Husserl) as indicators that can be transformed into other indicators and grouped into indicator classes by their roles in transformations; 2. semantic information (meaning for the human user) of both indicator classes and transformations must be explicitly described and available for assessment and validation, 3. semantic information must be bound to the current scientific paradigm and to evidence based medicine through extensive bindings to published and reviewed works. 4. Decisions about processing of specific data by specific algorithms can be based on semantic descriptions of the respective indicator classes and transformations. Both data and algorithms can be theoretically shared

even across various conceptual domains if documented semantic links that support such interconnection exist. This emphasize on semantic information and the need for its extensive review when linking data with algorithms brings a further requirement on practical implementation of a system based on these theoretical principles: besides mechanisms of trust and security as they are understood in current computer networking, 5. mechanisms of procedural authority and trust must be implemented to support users' decisions about the procedural and semantic value of individual components.

*Results:* Based on the described methodology, algorithms (and their respective data structures) from several different domains of medicine (auxology, cardiology, sports medicine) are being documented and implemented as web services. These web services can be easily linked and utilized by other applications, including e.g. LAMP (Linux, Apache, php, MySQL) applications or MS Office documents.

*Conclusion:* Feedback from end users of the MediGrid system for sharing biomedical knowledge is encouraging, as well as the theoretical reflexions of practical implementations. Supported by Medigrid, Czech research project No. 1ET202090537.

### **A web-based infectious disease communication system to enhance healthcare workers' knowledge, attitude, and risk perception about safe work practices**

F. Verhoeven<sup>a,\*</sup> ([f.verhoeven@utwente.nl](mailto:f.verhoeven@utwente.nl)), M.G.R. Hendrix<sup>b</sup>, A.W. Friedrich<sup>c</sup>, I. Daniels-Haardt<sup>d</sup>, N. Nijland<sup>a</sup>, M.F. Steehouder<sup>a</sup>, J.E.W.C. Van Gemert-Pijnen<sup>a</sup>

<sup>a</sup>University of Twente, Twente, Netherlands

<sup>b</sup>Public Health Laboratory, Enschede, Netherlands

<sup>c</sup>Institute for Hygiene, Münster, Germany

<sup>d</sup>Institute of Public Health, Münster, Germany

*Background:* Currently, infectious disease communication systems are more content-driven than user-oriented. In order to be effective, the system has to provide reliable, adequate information, and should enable health care workers (HCWs) to make the right decisions. Here, web-based communication systems can be an effective instrument [1]. To build such a system, it is necessary to investigate HCWs' knowledge, attitude, and risk perception concerning safe work practices.

*Objective:* To develop a web-based infectious disease communication system based on the available national Methicillin Resistant Staphylococcus Aureus (MRSA) policy, to enhance HCWs' knowledge, attitude, and risk perception concerning safe work practices.

*Methods:* A validated questionnaire was used to get a general impression of HCWs' knowledge, attitude, and risk perception about safe work practices regarding MRSA. This general impression was further analyzed by scenario-based tests with HCWs. Both approaches provided us with HCWs' key questions concerning safe work practices. To further fit HCWs' needs, the questions were categorized into groups by the Card Sort Method and analyzed by WebSort software in order to provide a user-centered search structure for the web-based communication system. The study was conducted among physicians, nurses, and domestic staff in four hospitals in Germany and the Netherlands.

*Results:* The results of 276 questionnaires showed inadequate levels of knowledge (97% of respondents) and risk perception (24%) about safe work practices, and negative attitudes (63%) toward complying with these practices. The 28 additional interviews demonstrated that lack of knowledge is mainly related to being uninformed about transmission routes of MRSA (14%), resulting in an inadequate perception of the personal risk to obtain and transmit MRSA (10%). A negative attitude is caused by HCWs questioning the usefulness of adhering to safe work practices (14%). These factors lead to

non-compliance with safe work practices. HCWs seem to favor a more personal and social approach of safe work practice documents, stressing personal risks and the rationale behind applying the practices. In sum, 134 key questions were found about which the knowledge, the attitudes or the risk perceptions were unsatisfactory. The web-based communication system should address these questions. The Card Sort Method ( $n = 12$ ) resulted in ten categories in which the key questions can be grouped. HCWs are best served with a web-based system in which they can actively search these questions in their own language both via a search engine and a table of contents representing HCWs' terminology and information needs.

*Conclusion:* Our study indicated that the used mixed-methods design provides a powerful approach to analyze HCWs' key questions concerning safe work practices, and provides us with a search structure for a user-centered web-based communication system. HCWs' involvement in the development of web-based communication systems might encourage compliance with safe work practices [2,3]. This remains subject for further investigation.

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## A personal health care record (PHR) based on international open standards facilitates true patient empowerment

S.F.F. Verlinden<sup>a</sup> (*stef@vivici.nl*), G. Freriks<sup>b</sup>

<sup>a</sup>*Vivici BV, Leiden, Netherlands*

<sup>b</sup>*Conexis, Buitenkaag, Netherlands*

*Background:* True patient empowerment starts with the control over your own health data. The person who controls the data is primary responsible for the whole picture and can assure quality of treatments, services and care provided. Of course patients can delegate this responsibility to f.i. their family doctor. In that case an underlying 'service level agreement' should take care of the mutual expectations and responsibilities. Traditionally patient records are generated, maintained and controlled by the individual health care providers. This results in fragmented bits of data stored somewhere in the office of the healthcare provider who generated it. Currently, at least in the Netherlands, most health care records are based on proprietary software, which doesn't connect to open communication standards. As a result data isn't shared between healthcare providers. Therefore no person has the complete picture, specifically the subject of all of this: the patient.

*Objective:* To provide a web based PHR that facilitates true patient empowerment, optimal patient care that allows plug and play interoperability.

*Methods:* A web based PHR is developed based on the international open European standard CEN/tc251 EN-13606 [1] and the openEHR information model [2].

To guarantee privacy, medical and personal data are physically separated and controlled by different institutions. No data that can uniquely identify the patient is stored in the PHR. This and the fact

that the secret key to connect an individual to a PHR is controlled by an independent organisation, guarantees the privacy. To enter and view data, archetypes [3] for each separate knowledge domain were created using the Archetype editor [4]. Besides the demographic archetype, archetypes were created for actual disease/disorders and episodes, actual medication, length, weight, blood pressure, blood-glucose, cholesterol and vaccinations.

*Results:* Compliance to the EN13606 and use of the openEHR architecture provides ‘plug and play’ semantic interoperability. As integrated part the system generates a complete and detailed audit trail: every data entry point can be retrieved in its original context digitally undersigned by the responsible person.

The latter is crucial to address juridical-legal issues such as responsibility. These issues will occur more and more in the near future when the (Dutch) government enforces ‘chain-care’ concept that will force healthcare providers to use data generated by others.

After secure login via a webpage, patients and health care providers can enter and share health related data via a secure web portal that is available 24x7 through the Internet.

*Conclusion:* Essential for true patient empowerment is control over your own healthcare data. Systems offering this control also should guarantee privacy, provide plug and play semantic interoperability and deal with legal-legal issues. An Internet based PHR is generated which, due to the fact that it complies with international open European standards and information models (EN 13606 and openEHR), meets these requirements. Patients can enter, access and share their healthcare information safely with whom they chose and therefore take control over their own health.

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## **AQUA (Assisting Quality Assessment): A system based on Semantic web and information extraction technologies to support medical quality labelling agencies**

D. Villarroel<sup>a,\*</sup> ([villarroelgonzales@azq.de](mailto:villarroelgonzales@azq.de)), M.A. Mayer<sup>b</sup>, A. Leis<sup>b</sup>, V. Karkaletsis<sup>c</sup>, K. Stamatakis<sup>c</sup>, V. Metsis<sup>c</sup>, P. Nasikas<sup>c</sup>, M. Labský<sup>d</sup>, M. Ruzicka<sup>d</sup>, V. Svátek<sup>d</sup>, F. López-Ostenero<sup>e</sup>, V. Peinado<sup>e</sup>, E.A. Cabrera<sup>e</sup>, T. Honkela<sup>f</sup>, M. Pöllä<sup>f</sup>

<sup>a</sup>Agency for Quality in Medicine (AQuMED), Berlin, Germany

<sup>b</sup>Web Médica Acreditada (WMA) of the Medical Association of Barcelona (COMB), Spain

<sup>c</sup>National Centre for Scientific Research “Demokritos” (NCSR), Greece

<sup>d</sup>University of Economics in Prague (UEP), Czech Republic

<sup>e</sup>Universidad Nacional a Distancia (UNED), Spain

<sup>f</sup>Helsinki University of Technology (TKK), Finland

*Background:* Internet offers an undreamt-of possibilities of publishing health information and spreading it to a large readership. Additionally it is well-known that the quality of this information varies a lot. Therefore label agencies (LA) saw the need to critically evaluate the quality of health information in internet. This happens however mostly “by hand”. The EU funded project MedIEQ (Quality Labelling

of Medical Web content Using Multilingual Information Extraction) [1] aims to give support in this field. MedIEQ purposes to pave the way to an automation of the quality appraisal of medical information in Internet.

*Objective:* To present MedIEQ work, the assisting system for LA of medical web sites called AQUA (Assisting Quality Assessment). This system is based on semantic web and information extraction technologies.

*Methods:* AQUA supports the work of the labelling expert in three different aspects: 1. It searches the Web looking for unlabeled websites, 2. it reviews the medical web resources according to a set of machine-readable criteria creating a RDF/XML label. The criteria were selected by two labelling agencies who participate in the project (WMA and AQuMed) taking into account their own criteria as well as international known initiatives: HON Code and the recommendations of the EC in eEurope 2002: Quality Criteria for Health related Websites [2–5]. The automatic RDF/XML label is created extracting certain information according to these criteria using Information Extraction (IE) technologies. 3. Finally, it monitors automatically the web resources in order to identify modifications against the criteria and it alerts the expert about it. AQUA supports two languages, Spanish and English. The system is based on an open architecture, so that the number of criteria can be adapted depending on LA needs. AQUA final prototype will support seven languages.

*Conclusion:* Using AQUA, it is expected that the number of quality-rated web pages increases as well as their effective monitoring reducing LA's efforts. This will have a significant influence on the quality labelling of medical information in Internet. An evaluation of AQUA is planned in order to examine how AQUA is affecting the expert's performance.

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## MediGRID – Grid computing for cooperative work in eHealth

A. Weisbecker\* ([anette.weisbecker@iao.fraunhofer.de](mailto:anette.weisbecker@iao.fraunhofer.de)), J. Falkner, J. Bart

*Fraunhofer-Institut für Arbeitswirtschaft und Organisation, Institut für Arbeitswissenschaft und Technologiemanagement, Universität Stuttgart, Stuttgart, Germany*

*Background:* Grid computing is a model for the usage of distributed resources. It provides an information technology infrastructure for ehealth which enables collaborative work across different organisations and the shared usage of data and applications under consideration of security and privacy [3,4]. This aim of an interdisciplinary and widely location-independent collaboration between different institutions in medical research and care needs grid services in a controlled e-Science platform which is continually available, economically calculable and secure.

*Objective:* The presentation shows a grid infrastructure which supports the cooperative work in ehealth by the example of MediGRID [5]. MediGRID is part of the German e-Science initiative D-Grid

and has implemented grid computing for medicine and life science. The presentation shows the major MediGRID middleware components. These are a portal for the easy access to the grid resources, resource management and enhanced security as well as the user-centred design process which has been used to build up a grid environment for a heterogeneous user group [1]. Furthermore grid services in connection with electronic health records or patient controlled personal health records enable personalized medicine [6].

*Methods:* The development of the grid services is based on a service oriented architecture. For the users a portal builds the entry to all grid resources. The portal was designed and tested alongside the methods and processes of User Centred Design (UCD) [2] and the Portal Analysis and Design Method (PADEM) [8]. UCD always keeps the requirements of the users in the centre of attention and is based on the design of interaction between users and the system referred to as interaction design.

*Results:* The advantages Grid computing in medicine and life science are a substantial reduction of overall processing times and an easy-to-use access to applications together with a transparent access to various distributed information sources of academic and clinical providers. Grid computing supports patient centric integration of information across different institutions and sectors under consideration of data protection and privacy [7]. It enables the development of new medical applications and services.

*Conclusion:* Grid computing offers a promising opportunity for the support of future collaborative work in medical research and health care. It provides a information technology basis for integrated health care and enhances the collaboration between the different parts of the medical care chain like doctors, hospitals, care centres etc. The better availability of information and the enhanced collaboration increases the quality in health care and the efficiency of the processes.

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## Computer experience of health workers at work and home and its relationship with computer attitude and computer anxiety to use computers

F. Yaghmaie<sup>a,\*</sup> (*farideh\_y2002@yahoo.com*), R. Jayasuriya<sup>b</sup>, P. Rawstorne<sup>b</sup>

<sup>a</sup>*Shadeed Beheshti University of Medical Sciences and Health Services, School of Nursing and Midwifery, Tehran, Iran*

<sup>b</sup>*University of Wollongong, Wollongong, Australia*

*Background:* Since computerised systems are increasingly becoming common in all work situations, end-user computing (EUC) has rapidly gained a great deal of attention in the management information systems (MIS) literature [1–3]. Computerised information systems or information technologies are important tools that can be used for a variety of purposes.

However, computerised information systems do not always improve organisational performance. For example, Brown et al. [4] studied the impact of the Bedside Terminal System (BTS) in a hospital. The results indicated that after implementation of the computerised system, registered nurses spent less time in direct patient care and their attitude toward the BTS changed negatively, while medication errors remained unchanged.

*Objective:* The aim of this study was to determine the relationship of computer experience of health workers at work and home on their computer attitude and computer anxiety to use computers.

*Methods:* In this descriptive study, computer experience was measured by two questions in the context of 1. Work /education, and 2. at home. To measure computer attitude, a scale developed specifically to measure Nurse's Computer Attitudes (NCATT) was chosen [5]. The NCATT has been shown to have three factors; 1) patient care 2) computer anxiety 3) patient confidentiality.

The sample of this study consisted of nurses and health workers who were employed in community health centres in the Australia. The data was collected through a questionnaire.

*Results:* The data showed that participants with computer experience in an educational or and/work context, had significantly higher scores on the computer attitude variable compared with those participants without such experience. Similarly, those who had access to a computer at home had more positive computer attitudes than those without such access. The results indicating that those participants who had a computer at home showed lower levels of computer anxiety, but had more positive attitudes in relation to the use of a computer for patient care, and for patient confidentiality, than those participants without a computer at home. In addition, participants with computer experience in work and/or education, had more positive attitudes in relation to the use of computers for patient care, and patient confidentiality, and had less computer anxious, than the participants without any computer experience at work and/or education.

*Conclusion:* From these results it would seem that participants with computer experience in education or work had more favourable computer attitudes than others with no computer experience, is consistent with findings of other studies [6,7]. In the current study, those people who had access to computer at home had more positive attitude and lower level of computer anxiety than those without such access [8]. Based on the results of this study, computer experience at work and home may provide an outlet for users to overcome any fear associated with computer use.

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### Understanding computerised information systems usage in community health

F. Yaghmaie\* (*farideh\_y2002@yahoo.com*)

*Shadeed Behesthi University of Medical Sciences and Health Services, School of Nursing and Midwifery, Tehran, Iran*

*Background:* Discussions of computer systems effectiveness or system success frequently focus on questions of which factors provide better system usage. As there are many factors that affect computer system usage, measuring the influence of the factors is necessary.

*Objective:* The objective of the current study was to gain a further understanding of some factors that affect the use of computerised information systems. Most studies have been in business and few studies have been conducted in the health sector and specifically in community health. The study measured the role of external variables on computer attitude, subjective norms and intention to use computers based on the Theory of Reasoned Action (TRA) [1]. These external factors included: demographic characteristics, users' characteristics (computer experience), organisational support, and involvement.

*Methods:* After a thorough search of the literature the researcher found valid and reliable scales for measuring the above variables. A questionnaire that consisting of 62 questions that covered users' characteristics (positive and negative subjective computer experience) [2], management support, (general support and information centre support) [3], users' involvement (importance and personal relevance) [4], computer attitude [5], subjective norms [6] and intention to use computers [6] was developed.

Then study was conducted in the Community Health Services of one Area Health Service in New South Wales, Australia. The questionnaires were mailed to 430 staff (nurses and health workers) in 51 Community Health Centres in the Illawarra Area Health Service. A response rate of 70% (302) was achieved. The data was analysed using a statistical computer program (SPSS). Structural equation modelling was used to test the measurement model and the structural model. Overall, high support was found for the structural model in this study.

*Results:* The results showed the influence of positive computer experience on computer attitude, the effect of negative computer experience negatively on subjective norms. The results also showed that negative experience had positive and direct affect on subjective norms. The other new finding of this study was the direct effect of importance and personal relevance on intention to use computers. The results also supported other studies on the importance of organisational support regarding intention to use systems. Moreover, computer attitude and subjective norms were also found to mediate relationships

between external validity and intention to use computers. In general, the study was able to explain the variables that affected the intention to use computers directly and indirectly.

*Conclusion:* This study was an important step in finding the relationship between external variables and variables in the TRA in a different and new setting such as; community health centres. This study indicates that beliefs about system usage may not be sufficient to affect behaviours if individuals have not abilities to use computer technology. This study identified factors that could predict system usage.

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## Screening hidden and multi-faceted risk groups for infectious diseases: Development of an anonymous hepatitis C screening procedure through the Internet

F.R. Zuure<sup>a,\*</sup> ([fzuure@ggd.amsterdam.nl](mailto:fzuure@ggd.amsterdam.nl)), U. Davidovich<sup>a</sup>, G.J. Kok<sup>b</sup>, C.J.P.A. Hoebe<sup>c</sup>, J.A.R. van den Hoek<sup>a,h</sup>, P.L.M. Jansen<sup>d</sup>, P. van Leeuwen-Gilbert<sup>e</sup>, R.A. Coutinho<sup>a,f,g,h</sup>, M. Prins<sup>a,g,h</sup>

<sup>a</sup>Health Service of Amsterdam, Cluster Infectious Diseases, Amsterdam, Netherlands

<sup>b</sup>School of Psychology, University of Maastricht, Maastricht, Netherlands

<sup>c</sup>South Limburg Public Health Service, Geleen, Netherlands

<sup>d</sup>Liver Center, Academic Medical Center (University of Amsterdam), Amsterdam, Netherlands

<sup>e</sup>National Hepatitis Centre, Netherlands

<sup>f</sup>Centre for Infectious Disease Control, National Institute for Public Health and the Environment, Bilthoven, Netherlands

<sup>g</sup>Center for Infection and Immunity Amsterdam (CINIMA), Academic Medical Center (University of Amsterdam), Amsterdam, Netherlands

<sup>h</sup>Department of Infectious Diseases, Tropical Medicine & AIDS, Academic Medical Center (University of Amsterdam), Amsterdam, Netherlands

*Background:* Hepatitis C virus (HCV) infection can lead to liver cirrhosis and hepatocellular carcinoma. It is estimated that 170 million people are infected with HCV worldwide. In the general Dutch population the prevalence is estimated to be 0.1–0.4%. Because of recent advances in the treatment of HCV, informing the population at risk is important. However, since there are various risk factors for HCV, the target groups are multi-faceted and often difficult to reach. Furthermore, HCV awareness is low in the general public as there has been no national information campaign on HCV yet. This pilot project aims to inform, trace and test risk groups in the general population for HCV through an Internet screening.

*Objective:* The project aims (a) to evaluate the effectiveness of the open media campaign to motivate risk populations to take part in the online anonymous screening procedure, (b) to evaluate the success of the screening procedure to trace HCV infected individuals and (c) to retrieve knowledge concerning HCV risk factors, and outcomes in the Netherlands.

*Methods:* An open media campaign will start March 2007 to attract and refer individuals at risk for HCV (e.g. blood product recipients before 1992, former injection drug users and migrants from high prevalence countries) to the project's website at [www.heptest.nl](http://www.heptest.nl). Here, visitors will be motivated to fill out a short interactive questionnaire which assesses the participant's risk for HCV. If the participant is at risk for HCV, anonymous HCV serological testing in a laboratory will be arranged online. The results of the blood test will be available online after one week. Subsequently, HCV positive participants will be invited for a confirmation blood test. Chronically infected participants will be referred to a hepatologist for further diagnostics and treatment if indicated. The online procedure will be offered for 12 months. We aim to test 6000 individuals for HCV.

*Results:* In order to determine the sensitivity and specificity of our HCV risk assessment questionnaire, we asked both HCV negative and positive patients of three liver outpatient clinics in Amsterdam to fill out the questionnaire and to write down their perceived route of infection transmission. Data collection is still ongoing. Preliminary results show a sensitivity rate of 79% and a specificity rate of 82% ( $N = 65$ ). From March 2007 we will evaluate the reach of the open media campaign, the extent in which participants are at risk for HCV, and whether those at risk for HCV use the project's website to get tested. In relation to this, the usability and acceptability of the online screening procedure as perceived by the participants will be measured. Finally, cost-effectiveness analysis will be performed on the clinical outcome of the screening procedure.

*Conclusion:* According to the preliminary results, the sensitivity and specificity of the online screening instrument seem robust. During the conference we will present the first data on the use and acceptability of the method.