2002

Electronic Patient Record in the Netherlands, Luctor et Emergo; But Who is Struggling and What Will Emerge?

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ELECTRONIC PATIENT RECORD IN THE NETHERLANDS, LUCTOR ET EMERGO[1]; BUT WHO IS STRUGGLING AND WHAT WILL EMERGE?

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ABSTRACT

The opportunities for IT in healthcare seem to be endless in this digital economy but research in practice learns that there is a big gap between IT opportunities and daily practice. The Electronic Patient Record is one of those opportunities but it has been so for more than a decade. National initiatives have not lead to nation-wide patient records and local initiatives have not crossed institutional borders so far. This paper characterises EPR in three orientations: administration, medical technology and care process. It describes national and local initiatives that grow beyond one orientation. Four criteria are developed for a successful EPR from the end-user viewpoint. These are relevance, all data available, available to all relevant caregivers and active systems. Our hypothesis is that only an initiative that is found in the intersection of all three orientations can meet all four criteria. The initiative that comes closest to that intersection is tested for these success factors. One important conclusion can be drawn. As long as there is no co-operation of all three orientations there will be no complete EPR and therefore no successful EPR.

1. INTRODUCTION TO THE SITUATION IN THE NETHERLANDS AND GOAL OF THE RESEARCH

The electronic medical record has been pursued as an ideal by so many, for so long, that some suggest that it has become the Holy Grail of Medical Informatics (KAY and PURVES, 1996). TOUSSAINT and BERG (2001) conclude that the lack of success of the research effort is mainly due to its technological bias. The introduction of an EPR system involves beside technology changes, major personnel and organisational changes (ATKINSON and PEEL, 1998).

In a survey on automation in Dutch hospitals in 1999, a quarter of the responding hospitals reported the use of some kind of EPR in 1999 (HARMSEN, 2000). This is about the same as reported in 1996. More than half of the rest had the intention to buy one. This is also about the same as in previous years. So some 40 % of the Dutch hospitals continue to express the desire to use an EPR, without actually buying one. The same survey reveals the main reason for this lingering. The ideal EPR for the Dutch market isn't available yet.

[1] Luctor et Emergo (I struggle and emerge) is the heraldic motto of the province of Zeeland, the part of the Netherlands that has been living in a constant struggle with the sea.

At the same time a lot of initiatives arise in the Netherlands to accomplish an Electronic Patient Record (EPR). People start enthusiastic and motivated, but unfortunately the results of the EPR-projects are often disappointing (BERG et al. 1998). It proves to be much harder to build a working EPR that meets all demands of the users, than is expected. Technical, organisational, financial, political, and legal obstacles must be faced. For this reason 'EPR' has become a word that evokes mixed feelings in people.

According to TANGE (1995) a large group of physicians is still satisfied with the paper medical record. Why going on then and not deciding to continue to use the paper patient record? Because healthcare changes and becomes more and more a sector, where information and communication are crucial processes. And that is where the paper record fails. The paper record system is incapable of supplying caregivers with *all* the patient information they need at the right time and the right place *all* the time (DRAZEN et al. 1995) in a way that they can utilise it (KÖNIGER and JANOWITZ, 1995; TANGE, 1995). A recent study of MAKOUL (et al. 2001) still showed that an initial visit with EPR physicians took on average 37,5% longer than those with control physicians. SCHURING and SPIL (2001) state that relevance to the user could be the most important bottleneck of IS success in healthcare.

For that reason we have started a research to answer the question:
Will the EPR-initiatives in the Netherlands lead to one successful EPR?
And if so, what will this EPR look like and what characteristics determine its success?
And if not, why? To answer these questions a research methodology is given in section 3.
In section 2 the definitions and assumptions on EPR will be given. Past, present and future developments are presented in section 4. In section 5 characteristics of success are discussed in relation to EPR. The subject of section 6 is a case-study. In the last section conclusions are drawn.

2. WHAT IS AN EPR?

There are many names and acronyms for computer-based systems in healthcare, such as Electronic Medical Record, Patient Care Information System, Electronic Care Record, Electronic Health Record, Computer-based Patient Record and Electronic Patient Record. This difference in nomenclature often reflects the different points of view of the authors or refers to different levels in functionality of the system.

Starting a dispute about nomenclature is not very useful here, since the projects, that we will investigate, all use their own definitions. We prefer the term Electronic Patient Record (EPR), because it places the patient in the centre. The ideal EPR is best described by combining the EHR and CPR as defined by the NHS an the Institute of Medicine respectively:

- *Electronic health record (EHR) – the concept of a longitudinal record of a patient's health and healthcare to combine information from primary healthcare with periodic care from other institutions (NHS, 2001).*
- *A computer-based patient record (CPR) is an electronic patient record that resides in a system specifically designed to support users by providing accessibility to complete and accurate data, alerts, reminders, clinical decision support systems, links to medical knowledge and other aids (OHIH, 2001).*

The ideal EPR is not restricted to the hospital organisation, but will cross its walls. This research uses the hospital organisation as a starting point and as a metaphor for healthcare organisations, because many parts of the hospital organisation will be involved in accomplishing such an EPR, each part representing a different group of stakeholders with different stakes and objectives, which influences the outcomes of an EPR-project and its success. MINTZBERG (1979) can be helpful in categorising internal groups of stakeholders for the professional bureaucracy: management, support staff, technical

staff and operational core. JORDAN (1994) makes it explicit that in professional bureaucracies too little ICT focus is given on the operational core. External stakeholders like patients, vendors, insurance companies and the government will not be handled in this paper.
Translated to the healthcare organisation the categories: management, administration, medical technology and care process are distinguished. The last three are comparative to the processes WALLEY and DAVIES (2001) describe. Figure 1 shows the three processes in relation to some categories of stakeholders.

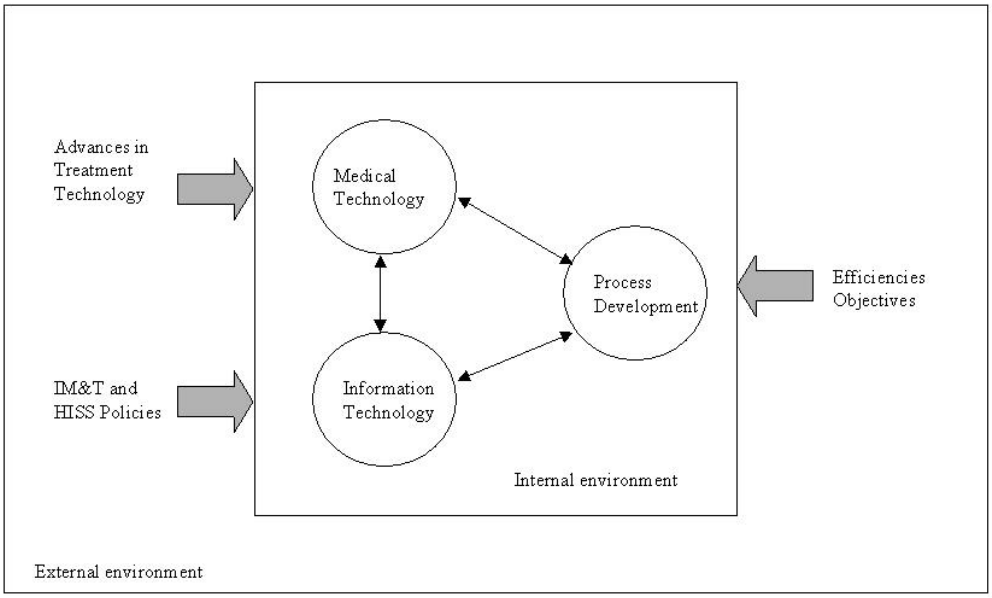

Figure 1. Interaction between Technology and Processes (WALLEY and DAVIES, 2001).

The description of WALLEY and DAVIES of the interaction between technology and processes inspired us to base our model on the relation between the three processes or orientations: administration, medical technology and care process, as shown in figure 2. We matched the categories of stakeholders with these orientations in table 1.

Orientation	Administration	Medical technology	Care Process
Stakeholder	Support staff Management	Operational core Technical staff	Operational core Support staff

Table 1: Relation between orientations and stakeholders

3. RESEARCH METHODS

This study was performed in three phases and for each phase the data gathering and research methods were different:

1. Evidence based literature study; From existing EPR literature we arrived at a categorisation model for EPR and from IS literature we gathered success factors for information systems, which we combined to factors of EPR success.
2. Document analysis; with all documentation available of Dutch EPR initiatives we selected and shortly described initiatives that go beyond one orientation. The documentation is listed in the appendix.
3. Case-study analysis; Finally we used a case-study method to explore the initiative that was active in all three orientations of the model and analysed the chance of national success for this initiative.

In the following section the situation in the Netherlands is described according to the orientations.

4. ORIENTATIONS AND DEVELOPMENTS (LUCTOR)

In this section we give a short chronological description for each orientation with in every prognosis paragraph examples of Dutch initiatives that are grounded in this orientation but are moving to other orientations. In the appendix these initiatives are summarised and categorised with listed documentation.

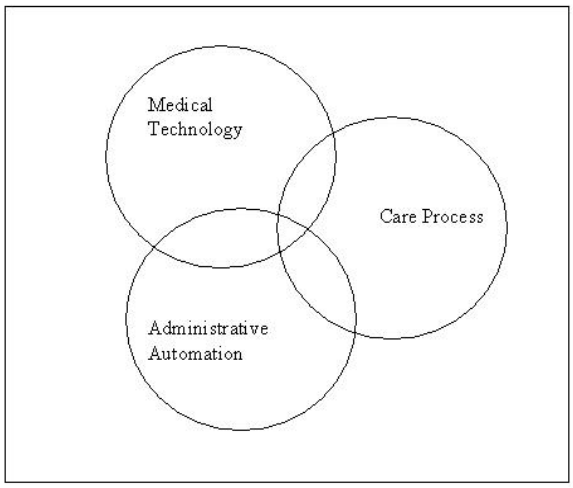

Figure 2: Orientations with their intersections.

4.1 Administration

History
COLLEN (1995) describes the history of the administrative automation in the United States. The program Medicare was launched in 1965 to aggregate care information. This system was used in the administration but not by the professionals who kept using the paper record. In the Netherlands the Leiden University Hospital started in 1972 with a project to come to an integrated Hospital Information System (BAKKER and LEGUIT, 1999).

Status praesens
Y2K can be seen as a marking point upon which many healthcare organisations have updated their HIS because many legacy systems did not support the year 2000 in their programs. It strengthened the point of view where healthcare organisations do not want to be dependent on one supplier. Suppliers therefore have to open up their systems for communication with other systems to survive.

Prognosis
All main players on the Dutch HIS market are developing an electronic patient record.
The smallest supplier stays closest to the patient administration with innovating internet functionalities (CS-EZIS), the middle (on market share) supplier starts of in the direction of care protocols (X care) and the largest supplier tries to integrate medical technology in its product (Mirador, EPR Cardiology). Beside that local initiatives (Zouga and INTRAZIS) try to use the intranet on top of their legacy systems.

4.2. Medical Technology

History
Picture Archiving and Communication Systems (PACS) date back to the early 1980's, when healthcare focused on IT's ability to communicate, exchange and distribute image information in an accessible and fast format (LUNDBERG and HANSETH, 2001). Traditionally, Intensive Care has

developed systems that already showed EPR functionality because life-threatening situations needed better information about the patient.

Status praesens
The clinicians referred to the electronic access of radiological text and images as top priority request. The internet has changed the possibilities (KAHN et al., 1997) and makes the images available.
Today the clinical laboratories can not accomplish their tasks without IT. IT is not only used for testing, but also for quality management, administration and distribution of the laboratory findings to the clinicians (VAN DEN BERG et al. 2000).
Anaesthesiology and intensive care-units have also become high-tech environments, where IT is an essential tool in the patient care.

Prognosis
LUNDBERGH and HANSETH (2001) have not found any PACS and Radiology IS systems integrated with any HIS at a hospital in Sweden. Their study illustrated however that the intranet applications have quickly developed into an essential part of the medical work practice. Standardisation and web-technology will play a main role in the dissemination of these developments. Many Dutch initiatives make the examination results available inside and outside the hospital.

IMS (Image Management System) is an example of a data warehouse from industry that is applied to a medical environment. Every authorised user can retrieve images from digital medical equipment.
The Zouga-platform is an interface based on web-technology that gives access to several information systems. The project stems from the radiology-department and supplies physicians with patient data from the HIS, radiology images and reports en medical literature (ROS and DEN HEETEN, 2001). There are two main problems, the ICT for Medical Technology does not communicate with the administrative systems and in most cases the views can not be adjusted.

4.3 Care Process

History
The introduction of information systems for general practitioners started around 1985 and has resulted in the use of the GP information system in 90% of the Dutch general practices (VAN ALTHUIS, 2000). Many of these practices use the IS for administrative functions only (LAGENDIJK et al, 2001).
The use of IT by medical specialists has not started until the start of EPR-projects.
Homecare organisations developed their own information system. Nursing information systems are developing, usually as isolated systems in nursing homes.

Status praesens
At this moment many initiatives devote itself to one group of patients. Examples of these health chain systems are diabetes systems (DEMS) and the Parkinson card. DEMS is an EPR meant for multidisciplinary use by caregivers concerned with diabetics. DEMS contains active components based on guidelines. The entered data can also be used for scientific research (UBINK-VELTMAAT et al. 2001). These projects show the need for patient centred information systems. At the same time patients are able to make their own personal health record on the Internet.
Apart from these projects focussed on health chains, initiatives for the exchange of messages between hospitals and general practitioners arise. These messages mainly concern the referral of patients.
The general practitioners suffer from legacy systems. Because of the small Dutch market and the large variance of systems, vendors are not interested in developing a new information system for GP's.
Home care organisations start to introduce mobile technology for their staff in order to facilitate the registration of the delivered care and time spent (WEBERS and RAMAEKERS, 2001).

Prognosis
In the near future, the Netherlands will have a care card ("zorgpas" in Dutch)(LOOS, 2001). A regional or national EPR requires unique patient identification and unique identification of caregivers and health care organisations. The zorgpas-project introduced a smart-card for patients with their unique number, basic personal data, insurance information and medical information for emergencies. The zorgpas project evolved to a project for the realisation of a nation-wide infrastructure for a nation-wide EPR.
From the projects that concern the exchange of messages, (like the uzorg-project) a strong desire for regional integration of IS's can be seen. Also a desire for regional co-operation, based on medical guidelines is seen. RHECO is set up by hospitals, general practitioners, pharmacists, laboratories and public health care to provide a system for electronic exchange of messages. In the future it will be expanded to an infrastructure for a regional EPR. As a first step the exchange of prescription-information and the recording of medication is planned.

5. WHEN WILL AN EPR BE A SUCCESS?

SAARINEN and SÄÄKSJÄRVI (1992) state that the success of an information system depends on the success of both the process and the product. Process success is determined by success of the development process and by success of the use process. Quality of the IS product and impact of the IS on the organisation result in product success.

According to GARRITY and SANDERS (1998) the success of the use process is the dominant factor. Success depends on user satisfaction and can be measured by measuring the dimensions: task support satisfaction (including decision-making satisfaction), quality of work life satisfaction and interface satisfaction. The involvement of the user can also seen as a repetitive item in the 3D-model of BALLANTINE (et al, 1998). The 3D-model distinguishes three levels (or phases): development, deployment and delivery. This model not only describes the factors that determine success, but also the factors that influence the decision to go from one level to the other. The importance of task support satisfaction is confirmed by SCHURING en SPIL (2001), who find relevance of the IS to the user, as the most important determinant for success.

Because of this crucial position of the end-user in IS success, we will define a successful EPR as an EPR that is used by the end-user when performing his core tasks. Although there can be more groups of end-users, we will focus on the medical staff as end-user of an EPR. In terminology of SAARINEN and SÄÄKSJÄRVI (1992) this means we are only interested in the success of the use process. This does not mean that the other three success factors are not important. They are less relevant for this study.

What does end-user-satisfaction mean for EPR?
An EPR-project can considered to be successful from a users viewpoint when it results in, or contributes to an EPR, that:
1. is relevant to the end-user (SCHURING and SPIL, 2001), i.e. solves the end-user's present (actual) problems, and supports the end-user's tasks (GARRITY and SANDERS, 1998)
2. stores all data at a patient level in a retrievable and integrated form for any patient (DRAZEN et al. 1995),
3. makes information available to relevant caregivers (DRAZEN et al. 1995) and
4. is "active", i.e. data are not only showed in a passive way, but intelligence is added, such as medical alerts, a prescription system, medical protocols. (ATKINSON and PEEL1998; SAFRAN et al. 1999).

In the next section we will present a case-study in which we analysed the chance of national success for this initiative according to the criteria mentioned above.

6. CASE STUDY (EMERGO)

In the region Utrecht, three initiatives come together, IntraZIS, UPID and Uzorg. The Antonius Hospital (VOS and KREDIET, 2001) started with an intranet application, called IntrazIS on top of its legacy systems to provide information about patients for all 2400 professionals in the organisation. To extend this application to all healthcare institutes in the region it is necessary to create a unique patient identification (UPID). Uzorg is a region wide initiative with the objective to improve communication between healthcare organisations and GP's. In this section we use the success model to describe the chance of success for these developments.

6.1 Orientation administration

Some four years ago, the medical specialists complained about the text-based interface of the HIS (ZIS in Dutch). Getting used to the GUI of Windows-applications, they desired a GUI for the hospital system too. They also longed for interconnectivity of the separate systems. Mirador, which was available, was rejected, because it was judged as too slow at that time. For this reason the programmer of the hospital decide to develop a new system by himself. This information system called IntraZis, uses web-technology to give access to the separate information systems in the hospital.
The success of IntraZIS, raised the demand to expand IntraZIS to an EPR. From April 2000 on the EPR-functionalities are realised and the improvement and expansion is a continuous process.
The IntraZIS originated from the administrative orientation (it is based on the HIS), but is connecting to the care process by e.g. supporting the incident-management in surgery. A connection to medical technology can also be seen in its capability to show images and lab-results with value-references.

6.2 Factors of success:

Relevance
How does the IntraZIS solve the present problems of the user?
A few examples shall be given. Surgery had a problem with the registration of incidents. This is solved by IntraZIS.
The emergency room exchanged its whiteboard for IntraZIS, because in this way the information needs not to be wiped out when the patient leaves.
One of the problems is, that it often takes a long time before a requested (and required) patient record is available. This is mainly due to two reasons: first the central archives are located in a different building than the caregiver. Second cause is the situation that a patient's record is at a fellow caregiver's desk. In this last situation it is usually hard to trace the patient's record.
This is not only inconvenient for the caregiver, but also means that relevant information like lab-results can not be added to the file. By this the patient's record is incomplete.
By IntraZIS the patient's information is always available and can be used by more than one person. And what is equally important, new information can be added as soon as it is generated (BIESBOER and VOS, 2001).

All patient data available
All existing information systems within the hospital are accessible by IntraZIS and also pharmacists information systems from outside the hospital. But not all medical information inside the hospital is stored in an information system, e.g. paper records are still used in the clinic. The threshold that must be overcome to cross the borders of the hospital is the unique patient identification. Different health care organisations use different ways to identify patients. The UPID-project has developed a solution to this problem, which will soon be implemented.

Available to relevant caregivers
The resistance of medical staff to unveiling the medical record is met by the design of the EPR. The patient record is divided in four sections: general patient information, shared medical information,

shared department information and specific department information. A department matches with a small out patient clinic or a medical (super-)specialism.
The department decides what information will be in which section and which users are authorised to see it.
Not all medical specialisms use the IntraZIS yet and so far the system is only used by doctors The emergency room is an exception: nurses use the system there too. The progression is slow due to capacity problems within the IT-staff.
Caregivers from outside the hospital have very limited access to the IntraZIS because of the identification problem and because of the variance of legacy systems used by e.g. GP's. The electronic communication between GP's and the hospital is supported by Uzorg and based on EDI.

Active:
The IntraZIS does not contain active elements such as medical alerts or an expert system.
The completeness of the information compared with a paper record should make it possible for the professional to make better clinical decisions. This study did not answer that question.

7. CONCLUSION

The research questions were:
Will the EPR-initiatives in the Netherlands lead to one successful EPR?
The minister of health announced that before 2004, the Netherlands should have a national EPR but this study cannot find too much ground for this optimism. The IntraZIS-project is promising, but it lacks active elements and it is only available for doctors. The scalability of the system is limited because there is not enough capacity available and because the unique patient identification is not realised yet.

And if not, why?
The initiatives seem too diverse and are not co-ordinated. They all have a specific background which makes it difficult to include the other viewpoints. Worse, the initiatives that have the same objective seem competitors. Still, some of the initiatives described are at least very useful as a learning process. The time it costs to determine a unique patient identifier, a prerequisite for the EPR might be an indicator of the time it will cost to implement a national EPR.

And if so, what will this EPR look like and what characteristics determine its success?
We do not know whether one successful EPR will emerge, but we do know that if so, it must integrate the results achieved in the EPR-projects from all three orientations. As long as there is no co-operation of all three orientations there will be no complete EPR and therefore no successful EPR. With determinations and financial support from the ministry of health it must be possible to create a national EPR in due time. This study can predict four scenario's of which only the fourth has a chance to be successful in becoming a nation-wide EPR or EPR-standard.

Scenario 1:
On top of the traditional HIS, an infrastructure will be build that enables all professionals to interact with necessary information in many (hidden) legacy systems. Access to medical guideline systems is added. The Internet protocols should be build upon a world-wide acknowledged standard and enable changes to be made in the source systems. The IntraZIS case as handled in this paper could be an example of how it can be done but knowledge and capacity problems prohibit that the local initiative itself will become national.

Scenario 2:
The Medical Technology Informatics will make it possible to view and operate all examination results in the healthcare chain and will have the information ready on the desktop of every professional that has permission to use it. For this scenario to become successful it should be able to communicate with

the administrative systems (outpatient agenda for instance) and dedicated to each patient group and specialism. A portal approach from the user perspective could be a good way to proceed.

Scenario 3:
The patient organisations together with health care professionals will implement patient group specific information data warehouses and workflow systems for both patient and professional. Systems to analyse data for medical research will be part of such EPR A generic model for all patients should be constructed to generate a general patient module and a specific disease EPR.

Scenario 4:
The obstacles for realising a unique patient identification will be overcome. All three orientations will work together. A web-based infrastructure as described in scenario 1 will be realised using open standards that make it possible to communicate with IS for medical technology also. The infrastructure gives access to an EPR that reflects a generic model for all patients, but also contains guidelines for specific diseases. This EPR is active in the way that medical alerts and workflow management, based on medical guidelines are part of it.

Further research:
This study did not comprise the development process and success factors related to the impact on the organisation. Further research should investigate their influence. The role of the management of health care-organisations and of external stakeholders should also be investigated especially regarding to their influence on the implementation and the supply of necessary resources.

Our future research will be directed to the intersection of the EPR orientation model between the orientations of which the intersection between the care process orientation and the administration orientation seems most promising. By exploring the care process of a specific patient group and all interactions with the care professionals we try to get to a generic model of the electronic patient record.

"God created the world and the Dutch created Holland."[2] Vendors created the HIS and health care created the EPR?
Hopefully there will be co-operation between government, vendors and health care professionals to establish a satisfying EPR for Dutch health care, so that healthcare workers no longer suffer from the risk to drown in the sea of patient-information (KÖNIGER and JANOWITZ, 1995).

REFERENCES

ALTHUIS, T.R. VAN, S.A.J.J. RIKKEN (2000). Electronic support for general practitioners in prescribing drugs. *Health information developments in the Netherlands*, 2000, 62-66.

ATKINSON, C.J. and V.J. PEEL (1998). Transforming a hospital through growing, not building, an electronic patient record system. *Methods of Information in Medicine*, 37, 285-293.

BAKKER, A.R. and F.A. LEGUIT (1999). Evolution of an integrated HIS in the Netherlands. *International Journal of Medical Informatics*, 54, 209-224.

BERG, G.A. VAN DEN, F. VAN DER GRAAF, P.J. HELMSING, F.P.A.M.N. PETERS (2000). *Klinische Chemie* (in Dutch). Nederlandse Vereniging Klinische Chemie, Utrecht.

BERG, M., E. GOORMAN, P. HARTERINK and S. PLASS (1998). *De nacht schreef rood* (in Dutch). Rathenau Instituut, Den Haag.

BIESBOER, J and A. VOS (2000). *Het elektronisch medisch dossier, aandachtspunten bij de realisatie* (in Dutch), University of Twente, Enschede.

COLLEN, M.E (1995). A history of medical informatics in the United States, 1950 to 1990. *American Medical Informatics Association*.

[2] This saying refers to the fact that a large part of Holland consists of polders, i.e. by people reclamated land below sealevel, protected by dykes.

DRAZEN, E.L., J.B. METZGER, J.L. RITTER and M.K. SCHNEIDER (1995). *Patient care information system*. Springer-Verlag, New York.

GARRITY, E.J. and G.L. SANDERS (1998). Dimensions of information success. In *Information systems success measurement*, (GARRITY, E.J. and G.L. SANDERS), 13-45, Idea group publishing, Hershey.

HARMSEN, J. (2000). *Automatisering in de ziekenhuissector* (in Dutch). Prismant, Utrecht.

JORDAN, E. (1994). Information strategy and organisation structure. *Information Systems journal,* 4, 253-270

KAHN, R; LEINER, B M, CERF V G, CLARK,D D, KLEINROCK, L, LYNCH, D C. POSTEL, J,ROBERTS, L E and WOLFF, S(1997) The evolution of the internet as a global information system. *The international information & library review,* 29 (2) 129-151.

KAY, S. and I.N. PURVES (1996). Medical Records and Other Stories: a Narratological Framework. *Methods of Information in Medicine*, 35, 72-87

KÖNIGER, P. and K. JANOWITZ (1995). Drowning for information, but thirsty for knowledge. *International Journal of Information Management*, 15 (1) 5-16.

LAGENDIJK, P.J.B., R.W. SCHURING and T.A.M. SPIL (2001). *Elektronisch voorschrijf systeem, "van kwaal tot medicijn"* (in Dutch).University of Twente, Enschede.

LOOS, J. VAN DER (2001). National roll out and development applications run parallel. *Health information developments in the Netherlands*, 2001 (4), 42-44.

LUNDBERG, N. and O. HANSETH (2001). Standardisation strategies in practice-examples from healthcare. In *Strategies for healthcare IS.*(STEGWEE, R. A. and T.A.M. SPIL), IDEA group publishing Hershey.

MAKOUL, G, CURRY, R.H. and TANG, P.C. (2001). The Use of Electronic Medical Records, Communication Patterns in outpatient encounters. *Journal of the AMIA,* 8, pp 610-615.

MINTZBERG, H. (1979), *The structuring of organisations: a synthesis of the research.* Prentice-Hall, Englewood Cliffs, NJ.

NHS, 2001. Defining electronic records. Www.doh.gov.uk/farends/sld010.htm

OHIH, 2001. Towards electronic health records. Office of health and the information highway, Canada. www.hc-sc.gc.ca/ohih-bsi/her/her-des/a-e.htm (2001).

ROS, M.G., and G.J. DEN HEETEN (2001). The radiology department as service provider for the electronic patient record. *Health information developments in the Netherlands*, 2001 (4), 48-52.

SAARINEN, T. and M. SÄÄKSJÄRVI (1992) Process and product success in information systems development. *Journal of Strategic Information Systems*, 1 (5) 266-277.

SAFRAN, C., D.Z. SANDS and D.M. RIND (1999). Online Medical Records: a Decade of Experience. *Methods of Information in Medicine*, 38, 308-312

SCHURING, R.W. and T.A.M. SPIL (2001). Relevance as a major driver of Innovation diffusion of ICT in Healthcare organisations. In *Proceedings of the Hospital of the future*. University of Twente, Enschede.

TANGE, H.J. (1995). The paper-based medical record – Is it really obsolete? *Computer Methods, Programs Biomed,* 48, 127-131.

TOUSSAINT, P. and M. BERG (2001). The electronic patient record as an organisational artifact. In *Strategies for healthcare IS.* (STEGWEE, R. A. and T.A.M. SPIL), IDEA group publishing Hershey.

UBINK-VELTMAAT, L.J., G.A.J. BROEKHAAR, R.O. RISCHEN, B. MEYBOOM-DE JONG and H.J.G.BILO (2001). The diabetes electronic management system. . *Health information developments in the Netherlands*, 2001 (4), 34-36.

VOS, A.M. and G.D. KREDIET, G (2001), Keep what's good, combine what's new. *Health information developments in the Netherlands*, 2001 (4), 45-46.

WALLEY, P, and C. DAVIES (2001). Implementing IT in NHS hospitals – Internal barriers to technological advancement. In *Proceedings of the Hospital of the future*. University of Twente, Enschede.

WEBERS, K. and E.F.D. RAMAEKERS (2001). E-health in home care. *Health information developments in the Netherlands,*2001, (4) 56-61.

APPENDIX

EPR-project	***Administration***	***Medical Technology***	***Care Process***
IntraZIS/Uzorg/UPID www.uzorg.nl	++	+	+
Zouga www.amc.uva.nl	+	++	
RHECO www.rheco.nl	+	+	++
Zorgpas www.zorgpas.nl	+		+
Mirador www.hiscom.nl	++	+	
CS Patient www.chipsoft.nl	++		+
XCare	++		+
Parkinson pas			++
DEMS		+	++
IMS (http://www.azvu.nl/nieuws/ jaarverslag97/patalg.html)		++	

++ = orientation where the initiative started
+ = orientation to which the initiative is expanding