Barriers to implementation of a clinical information system in an emergency department

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Abstract. Utilization of clinical information software at Departments of Anaesthesiology and Resuscitation becomes more and more frequent. In the Czech Republic, there is just one implementation. This study presents a technical description of the system specifying technical parameters, the way of data transmission, the integration of the system with the hospital information system, inputs, outputs, and its behaviour in practical operation. This problem is topical and many emergency departments investigate information system implemetation problems, as can be seen from the number of papers published on the topic recently [1, 2]. We describe an implementation in a Prague university hospital. The essential part consists in an analysis of barriers that emerged during the implementation, and a suggestion of how they could be eliminated. Namely, barriers of the technical, organizational, personnel and financial character were discovered and discussed. The problems were solved by the project management and change management methods that showed to be an effective tool. Finally, the main benefits of the implementation of a clinical information system at the Department of Anaesthesiology and Resuscitation are summarized.

Keywords: clinical information system, system implementation, analysis of barriers.

1 Background

System description

CIS is a clinical information system designed for gathering, storing, processing and presentation of data in collaboration with independent bedside instruments and auxiliary systems that are connected either directly or via data networks. It is specified for healthcare providers, above all for the field of intensive care medicine, where is allows for keeping complete, rapid and clearly organized medical and nursing documentation.

The CIS clinical information system imports data from bedside instruments, i.e. vital signs monitors, ventilators, infusion devices, stores them safely, and displays them in specific tables and records on practical bedside terminals. One of the advantages is also the possibility of mutual communication with the other subsystems of the hospital information system, e.g. different laboratories, the digital images storage of the radiodiagnostic complement, and/or other clinical information systems.

The CIS clinical information system further supports clinical analyses, reports, manual and/or automatic printouts and statistics. The system assists the clinicians,

nursing staff and the whole team with medical care management, records its delivery, and supports different documentation needs.

The following figure shows the CIS information system integration (Fig. 1). Arrows denote the direction of communication between individual modalities within the hospital information system.

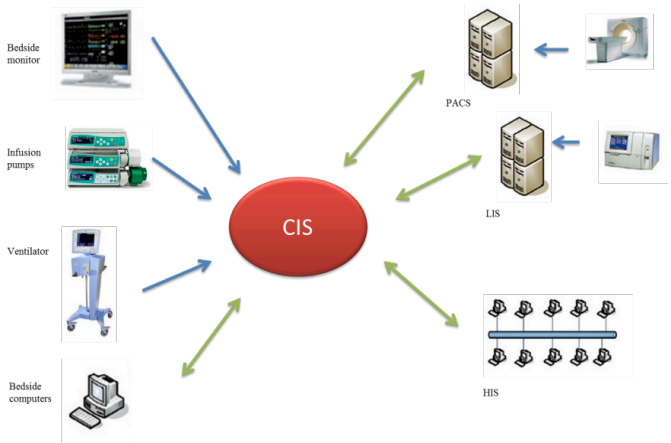


Fig. 1: CIS information system integration – direction of communication

Advantages of the system

- saving of non-productive time of healthcare staff
  - elimination of healthcare staff paperwork
- clearly organized, complete and transparent documentation
  - backward records of patient state during whole hospitalization
  - possibility to create and store picture records documenting the c course of the treatment
  - hospital documentation of patient´s admission, transfer, and discharge
- support to clinical decisions of the team of physicians:
  - continuous documentation of patient´s health state
  - real-time graphic representation of physiological functions curves
  - automatic evaluation of data monitoring patient´s health state, enabling allowing for a correct and rapid decision
- increase in health care efficiency
- cost control
  - allows both health insurance companies and hospitals to establish funds spent
  - makes accounting for undelivered interventions impossible
- automatic documentation of device functioning
- easy archiving and statistics

Implementation of the CIS clinical information system in a Prague university hospital

The urgent care department of a Prague university hospital is a top-ranking establishment providing anaesthesiology and resuscitation care for adult and paediatric patients. From the point of view of the number of physicians, other medical workers, as well as the scope of medical activities it is the biggest facility in the Czech Republic. Hence, it is obvious that it strives to be on the top of the current development in all spheres, including progressive information and treatment technology. That is one of the reasons why the hospital management decided to implement the clinical information system that proved successful at selected establishments abroad.

In the Prague university hospital, CIS is implemented in two wards of the adult part of the Anaesthesiology and Resuscitation Clinic. The Resuscitation Ward I provides eleven beds for critically ill patients and one bed for urgent admission, the Resuscitation Ward II provides twelve beds.

At present, the clinical information system is fully developed and operating in both wards of the Clinic. After the system has been tested and its reliability proved in practice, the hospital will consider continuing in implementation in the paediatric part of the Anaesthesiology and Resuscitation Clinic, in operation theatres, in the Intensive Care Unit of the Cardiology Clinic, and other Intense Care Units of the Hospital.

Expansion of the clinical information system is also planned in other healthcare facilities in the Czech Republic.

Technical securing of the project – System topology

In the Prague university hospital, the CIS clinical information system consists of the proper servers, client stations, and bedside devices.

Out of bedside devices, the following are connected with the clinical information system: vital signs monitors, the central monitor, ventilators, infusion pumps, and (linear setup) dispensing systems that all enable data to be continuously transferred. There will be efforts to integrate other devices as enteral nutrition, hemodynamic parameters monitors, and hospital beds later.

In Fig. 2, the topology of the clinical information system in the Prague university hospital is depicted. Technical data stated in this section have been provided by the supplier.

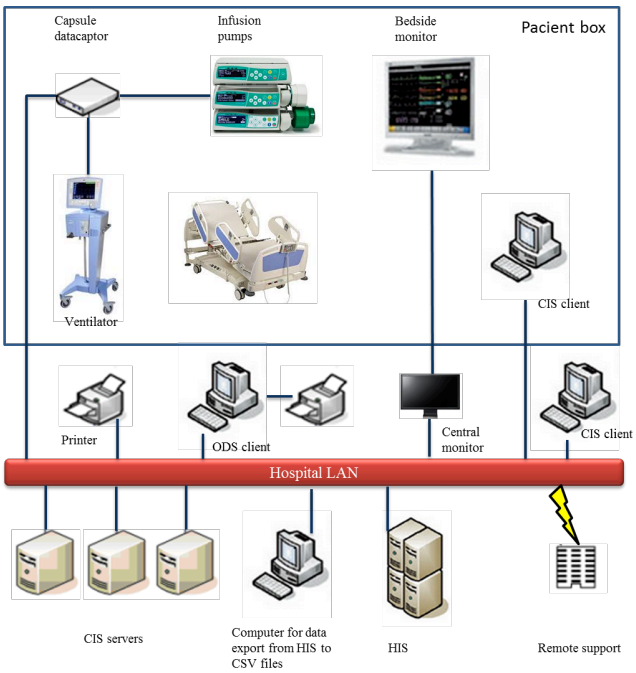


Fig. 2: Clinical information system - communication between Pacient box and hospital information system

Data transfer

The existing monitoring networks between monitors and the central monitor were used to transfer data from bedside monitors; it was only necessary to connect the central monitor to LAN. All measured and calculated data are transferred from central monitors to the CIS clinical information system using HL7 data and communication standard.

Data from ventilators (setting data, measured data, alarm values), and data from infusion pumps and dispensing systems (administration speed, bolus volume, pharmaceutical name) are transferred to CIS using the Capsule Datacaptor device.

Servers

In the Hospital, the CIS clinical information system is secured by three servers. The proper clinical information system runs on two servers (CISServer1, CISServer2). The third server (Interfacing Server) is used for communication with bedside devices and with the hospital information system. Table 1 shows an overview of server functions.

CISServer1	o Primary Server o Charting Server
CISServer2	o Data Analysis Server o Bedside Device Server o Enterprise Interface Server o Interface Configuration Server o Backup Server
CISServerR (Interfacing Server)	o Capsule Tech Device Interfacing Server o Rhapsody Server

Tab. 1. Server functions

Client stations had to be accommodated for the specific needs of the system. Above all, the number of client stations in bedside boxes had to be increased in both wards. Each bed is assigned an independent computer due to an individual character of the nursing care: each patient is in care of one nurse.

In Tab. 2 the reader can find a list of minimum hardware and software requirements for the client stations. The CIS system requires Microsoft.NET Framework release 1.1 to be installed in client stations. To switch on the CIS client, Czech standard local and language setting of the Windows operation system is required.

Component	**Requirement**
Processor Speed	1.6 GHz minimum
Bus Speed	533 MHz minimum
L2 Cache	512 KB minimum
RAM	2 GB minimum
Free disc space	2 GB minimum
LAN	TCP/IP 100 Mb minimum
Operation system	Windows XP Professional SP1 or SP2
Software	Microsoft.NET Framework 1.1
Software (on clients where the system is being configured)	Microsoft Access 2003 Visual Basic .NET 2003 Acrobat Reader

Tab. 2: Hardware and software requirements

Terminal devices

Central monitors

To central monitors from each ward are connected to CIS sending data in HL7 format to the CIS system. In each central there is a shared directory enabling the CIS system to download curves of vital signs functions.

Datacaptors

Datacaptors are devices collecting information from serial lines and sending them via ethernet network to the DataCaptor Server. The DataCaptor Server runs on CISServerR, translates all information to HL7 protocol, and sends to the CIS system.

Network requirements

Medical data are transferred between the servers in real time, hence a sufficient bandwidth is to be secured. A connection of 1GB/s is required between CISServer1 and CISServer2. The ideal connection of client stations is 100 MB/s, in adversity at

least 10 MB/s. For each bed, at least one connection point is required for Capsule Datacaptor with a ventilator and infusion pumps.

Interconnection with hospital information system

It has not been possible to arrange for the interconnection with the hospital information system in a standard way, since the specific IS of the Hospital does not support HL7 data and communication standard. It was necessary to implement so called Rhapsody Server to the system architecture that transforms information from the hospital information system into the HL7 format. However, this solution does not allow for the backward communication of CIS into HIS.

Only patient´s identification data, patient´s movements (admission, discharge), and laboratory results are transferred form NIS into the CIS system. The hospital information system exports these data to the CIS Interfacing Server in the form of CSV files. When a CSV file appears in the predefined directory, the Rhapsody system reads its content, and sends it using the HL7 protocol to the CIS system.

A scheme of HIS and CIS interconnecting is in Fig. 3.

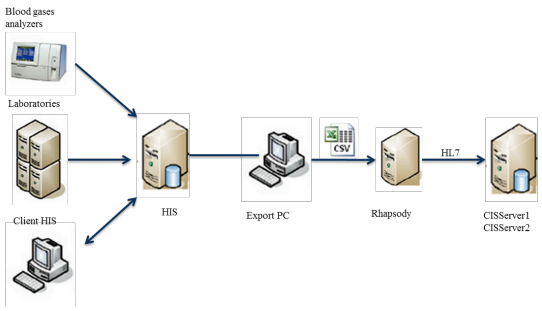


Fig. 3: Scheme of HIS and CIS interconnecting

System backup

Data in servers are mutually backuped. CISServer1 is the primary server, where all patient data are stored in SQL data bases. These data bases are backuped in the CISServer2 server.

In case of CISServer1 failure, the CISServer2 server can be set as the primary server, and the clinical information system can run on the CISServer2 server for the time of the failure. After the failure of the CISServer1 server is fixed, the transfer of data is necessary from the CISServer2 server back to the primary server of the system.

Each day, all data are backuped from the primary server to the CISServer2 server, and simultaneously, so called logs are stored on the CISServer2 server every 10 minutes. If the system crashed, the loss of data will be for no more than last 10 minutes of operation.

It is necessary to backup the system disc of each server incl. the system state data externally. The minimum recommended frequency of backup is monthly. Moreover, it is necessary to externally backup files placed on the CISServer2 server to allow for a recovery in case of a failure of the whole system.

Offline Document Storage (ODS)

ODS is a CIS system upgrade for a backup of important data for restoration, in PDF format to a local computer placed in the Department supervision room. In the case of the CIS system failure, network problems, and/or electric power supply failure, the staff can print all documents from the local station and continue in their work.

Enterprise Server controls operation of ODS and arranges for renaming and transfer of PDF files to the target computer; it is placed in the CISServer2 server.

DocExportClient looks after applications for management and viewing PDF files, once a day it deletes PDF files of patients that are no more in the Department, controls operation of the ODS system, and in the case of any problem sends an information email.

2 Organizational securing of the project

Start of implementation

The original vision of the project was prepared by the top management of the Hospital, and above all the Department that felt a need to improve work processes in the care of critically ill patients.

The basic requirement of the order was to deliver a clinical information system that could be integrated with bedside medical devices, and simultaneously with the hospital information system, incl. the laboratory information system and digital image storage. The main goal was to replace paper documentation (see Annex 2) by complex electronic documentation that would allow all patient health state information to be available clearly organized and at any time. The contract between the Hospital and the supplier was signed based on a public tender.

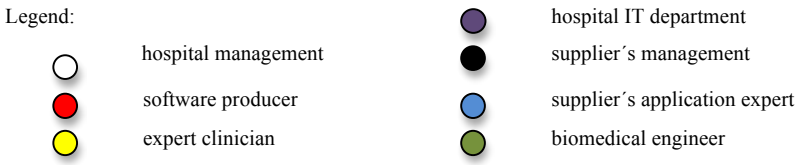
The course of implementation

The implementation of the CIS clinical information system in the Hospital was made first in the ARO I ward, where the system was tested and modified according to the customer´s requirements. After the system had been tested and proved in the full operation in all beds, the implementation in ARO II ward began.

Tab. 3 shows individual works of the implementation and problems that appeared in individual stages. The colours indicate implementation subjects or particular persons employed in the particular stages.

Activity	Problems
Designing the system - design of system structure - definition of requirements on HW, SW, and network infrastructure - requirements to remodel the rooms	No problems
Technical part - network infrastructure - rooms remodelling - RSN line installation – connection with the supervisory centre in Vienna	- remodelling not finished in time - different views of interconnection with supervisory centre, between the hospital IT department and SW producer - language barrier of some members of the team

- servers installation and configuration – installation of HW, SQL, KIS - clients installation – installation of HW, Windows, KIS - datacaptors installation – installation of HW, physical connection to the devices, setting the datacaptors, and communication - crash tests, load tests - administrators training - preparation of interconnection with HIS - interconnection with HIS	- not enough workstations in the department - failure of workstations delivery in time - failures in infusion pumps and dispensing systems connection during testing - HIS incompatibility – does not support HL7 protocol - different view of interconnection with HIS
Clinical part - preparing clinical configuration - clinical configuration of the system - configuration upload to the server - configuration testing - user´s manual preparation - trainers training	- SW modification according to client´s requirements: adjustment of drug generic names, translation - user´s manuals preparation - repeated testing of the system
Start in ARO I - user training - preparation of the start - start - support after the start	- network infrastructure failures - frequent system downtimes due to testing - insufficient staff training - low number of medical devices
Start in ARO II - user training - preparation of the start - start support after the start	- insufficient staff training - low number of medical devices
User´s training – data analysis	Not realized
Implementation finishing and evaluation	Not realized



Tab. 3: Individual works of the implementation and problems in individual stages

Differences in implementation in ARO I and ARO II

The differences in implementation in both wards followed from different procedures during launching the system.

In the ARO I ward, the system was launched first for two beds, where it was tuned and proved. However, the staff continued to keep paper documentation simultaneously. The enlargement to the other beds was realized stepwise, in a long time period. After the routine operation was applied to all beds, about 9 month after beginning the implementation, paper documentation was abandoned, and the staff started to work only with the electronic documentation.

In the ARO II ward, the system was first launched also only for two beds, however, without keeping simultaneous paper documentation. The staff worked only with the electronic documentation from the very moment of the launch. In three weeks, the operation was enlarged to all other beds.

Personal securing of the project - Implementation team

The implementation team consisted of people from the software producer, from the company implementing the software, and Hospital employees. The individual positions are given in Table 4.

Company	Function
Software implementing company	Project manager
Software implementing company	Application expert
Software implementing company	Technical adviser
Software producer	Integration expert (Germany)
Software producer	Technical adviser (Saudi Arabia)
Software producer	Technical adviser (Germany)
Software producer	Technical adviser (Germany)
Software producer	IT adviser, project manager (the Netherlands)
University Hospital	Expert clinician
University Hospital	Biomedical engineer
University Hospital	IT specialist

Tab. 4: Implementation team

3 Work methodology

To find implementation barriers, it was necessary to first identify and specify relevant data, analyse them, and interpret.

Data identification

At first, it was necessary to identify relevant data. Above all, these were technical data of the clinical information system, data concerning the course of implementation, and data describing the project´s organization structure. Next, we had to concentrate at individual steps and procedures of implementation incl. their time specification. It was also desirable to learn the opinion of the Hospital management, of the implementation firm, department IT workers, as well as the opinion of the clinical information system users.

Data collection

The necessary information was received through a personal visit and interviews with supplier´s management, with the project manager and application expert, through a personal visit to the technical department of the Hospital, and through interviews

with department IT workers in the Hospital. Furthermore, needed information was also gathered during a personal visit of the Anaesthesiology and Resuscitation Department. An individual interview was conducted with the management of the Department. By means of a questionnaire survey and interviews (see Annex 1), selected clinicians and nurses working in the Department were addressed. In order to reach 100% returnability of the questionnaire, a short interview followed with each respondent. To include a respondent into the research, he had to fulfil following two conditions: the respondent must be currently an employee of the Department with a minimum length of the employment of 2 years. These conditions were fulfilled by:

- ✓ 32 clinicians (anaesthesiologists serving in in-patient departments of the Hospital)
- ✓ 36 nurses from the ARO I ward (out of totally 52 nurses)
- ✓ 42 nurses from the ARO II ward (out of totally 54 nurses)

4 Survey results

In the scope of barriers identification, interviews were conducted both with the Hospital management and with the implementing firm´s management, and also with the Department head doctor, the application expert, clinicians and nurses. The objective of these personal interviews was to learn managers´ opinion on the reasons of system implementation, basic requirements, the way of project funding, and problems during the installation.

The problems during the implementation were connected with the scope of the project, the company had not had such a large order. Main problems consisted in setting the communication between the CIS clinical information system and the hospital information system. department IT workers showed little effort to collaborate. Also frequent failures of the system and the necessity of keeping duplicate information caused problems.

The funding of the project was secured through grants from EU funds with Hospital´s participation. The head doctor spoke also about possibilities of expansion of the system to the whole Anaesthesiology and Resuscitation Department, and/or to Hospital´s operation theatres.

The senior physician of the Department spoke about benefits of the CIS clinical information system, above all about removing some administrative works from the staff, and enhancing the care of patients. Furthermore, he spoke about advantages consisting in an interconnection of the clinical information system with laboratories and medical devices.

The funding of the project was secured within the EU complex, so called Traumatology program; a supply of a clinical information system was part of it. Requirements of a public competition were fulfilled, and the system was launched in the required time.

The general director of the company supplying software stated that the company won the order through a public tender. Customer´s requirements were very general; the company accepted it, however, it was necessary to modify the product according to customer´s needs. In his opinion, basic terms given in the contract were fulfilled;

after the supply was finished in time, the company only provided an application expert to accommodate the supply to Hospital´s specific requirements.

The application expert expressed his opinion on problems that appeared during the implementation. The main problems were bad collaboration with Hospital´s IT department, language barrier in some members of the team, outdated hospital information system that does not allow to utilize the clinical information system application in the full extent, and the fact that the Hospital failed to provide necessary human resources.

5 Survey summary

The survey had the following conclusions:

Most respondents value positively the following facts:

- management´s vision that means future enhancement of work processes, to reach the current European level in providing care in the urgent care departments. It is positive, although it was not presented to all workers shortly after the implementation.
- elimination of a large part of paper work, providing more time for the care of patients
- documentation reliability, transparency and conclusiveness – enabling e.g. elimination of peroral drug administration, which is common at present
- enhancing work processes and making work easier
- sense of higher status of the profession
- possibility to identify staff mistakes
- data statistical processing

Most respondents value positively the following facts:

- no chance to express one's own opinion on the CIS information system
- no information about implementation progress from the Department management
- management unwillingness to listen to users´ opinions and comments on possible improvements of the system
- collaboration with technical department that was evaluated very low by most respondents
- inappropriate quality of training
- workers motivation
- insufficient number of technical staff
- language barrier in technical staff

At present, nurses can see the real saving of time and enhancing the work with patients more intensely than physicians. Partly this is because the system does not utilize all options it can provide. This is caused by insufficient or inappropriate technical means that make this utilization impossible.

Some negative views that physicians have about the systems follow only from insufficient familiarization with the system, and also from certain conservatism of physicians who dislike changing their routine system of work.

6 Implementation barriers identification

Based on all available information, concrete problems and barriers were identified that contributed, in different degree, to project time schedule prolongation. The parties had to abandon their original plan, i.e. successful finishing the implementation within 9 months; they had to adapt the project more to the needs and requirements on the part of the customer.

7 Barriers analysis and recommendation to their elimination by means of change management

Since the system has been already implemented in the urgent care department of the Hospital, the recommendations for barriers elimination presented in this paragraph are formulated above all for implementation of the system in other wards of the Hospital, and in other health care facilities in the Czech Republic.

When implementing the system in other places, focusing on the critical areas is necessary that caused considerable prolongation of the project in a Prague university hospital.

Technical area

Insufficiencies in this field consist in unsatisfactory technical securing the implementation from the part of the ward and the Hospital. Several serious problems appeared.

Outdated hardware of computers in the Department wards

For high-quality operation and the possibility to utilize all benefits of the CIS information system, it is necessary to secure that bedside computers have corresponding parameters enabling wireless connection with patient´s electronic documentation even from a remote place, securing thus immediate information about his/her health state. Thus, physical presence of attending staff is not necessary at the bedside computer.

As stated above, computers in wards of the Department are technically unsatisfactory. The computers are outdated, slow, are not portable, and at the end they disable application of some benefits that the clinical information system provides. This fact affects negatively work of both physicians and nursing staff.

Remedial measures:

Replacement of stationary bedside computers with wireless portable tablet PCs; they themselves offer qualitatively totally different point of view on the health care staff work, and provide a lot of advantages impossible with classic PCs.

The first factor is the portability of these computers. Clinicians and nursing staff will have data available at any place and any time, they will not depend on their physical presence at the patient´s bed. This fact will surely be welcome by clinicians during ward rounds, consultancy, meetings etc.

Next radical benefit of wireless tablet PCs is the possibility to take photographs, video and/or sound recordings, and their storing in patient´s electronic documentation, which will lead to enhancement of work processes and the whole medical care. The staff will utilize these options e.g. to record dressing and healing of wounds and decubitus ulcers, where the picture documentation is irreplaceable, for patient education

about his/her health state, treatment options, or for research or study purposes. These devices significantly enhance user comfort.

Outdated medical devices

In the wards, outdated medical devices are in use that do not allow for online connection to the CIS clinical information system. These are e.g. infusion pumps, dispensing systems, enteral nutrition administration pumps, devices to replace the function of kidney – dialysis and similar. Therefore it is necessary that the nursing staff regularly – as a rule once an hour – manually recorded data into the CIS clinical information system. These are e.g. the speed of drug administration, amount of nutrition administered, etc. These administrative operations not only burden the nursing staff and divert their attention from activities that are irreplaceable – i.e. the care of the patient, but they can be the source of distorted records. If the nursing staff do not record these data regularly, the CIS clinical information system does not display these values. Hence, the system becomes much more dependent on the human factor, and does not utilize full scope and benefits it had been designed for.

Insufficient IS of the Hospital

The hospital information system in the Hospital does not allow for direct two-way communication with the CIS information system, since it does not support the HL7 data and communication standard that is the most spread worldwide. This situation caused significant delay as specialists from the delivery company had to search for an alternate solution of this problem. After long negotiations the company decided incorporate a specific server Rhapsody into the architecture of the information system; it converts data into the HL7 format, and sends them to the CIS clinical information system. Without such a solution, the clinical information system could not be implemented.

This fact continues to affect the clinical information system and its benefits, because no backward interconnection to the hospital information system exists. The company wanted to arrange for the backward communication by installing another Rhapsody server. The Hospital, however, did not accept this solution, and put up with a one-way connection. In future, this solution will cause incomplete integration with other clinical information system in the Hospital and in other health care facilities. This situation limits enormously the benefits of the CIS clinical information system.

Further technical problems during implementation of the system

Next barrier consisted above all in frequent failures of the network infrastructure and system downtimes due to excessive testing. When solving technical problems during the system implementation, workers of the Hospital and of the supplier differed in their ideas of their solution. The general manager of the supplier spoke about certain conservatism of some Hospital workers, based on some fear to launch a system that was not fully tested into operation. This resulted, in his opinion, in unnecessarily frequent testing of the system, even after minor changes. In contrary, Hospital workers insisted on testing each, even insignificant problem due to the fear of violation of the care of patients due to possible technical problems. This situation led to the mentioned superfluous testing.

Remedial measures:

This is a typical case of a barrier, where both involved parties were not able to find a compromise solution acceptable for both subjects. The remedial measure consists in

the fact that the project manager has to initiate negotiation, if necessary attended by the top management, where these problems shall be discussed thoroughly including all aspects.

Organizational sphere

Reasons of these barriers are based in an unsuitably formed organizational structure of the project and in insufficient communication between all subjects of the project.

In future implementations, it will be necessary to pay special attention to this problem and to concentrate much more on the nursing staff.

Insufficient organizational securing

In the run of the whole implementation it was obvious that organizational securing was insufficient, and this fact contributed to the delay of the project. Experts in change management agree that a powerful and complete management team is to be composed, that shall be able not only to manage all changes, but also to push then through. The project realization team must be equipped with adequate powers both from the part of the customer and the supplier.

The team for implementation of the CIS clinical information system was composed as follows: the supplier had in the team the project manager, application expert, and technical adviser. The software producer was represented by the integration specialist, two technical consultants, application specialist, and IT consultant. All members of the team nominated by the software producer provided their support from abroad, they were not continuously present on the spot. The Hospital was represented by an expert clinician, IT specialist, and a biomedical engineer.

It follows from the above stated that the team did not possess sufficient competencies. The representation of the Hospital in the team was insufficient not only as concerns the number of members, but above all due to an absence of a member of the Hospital management.

The expert clinician very actively participated in the implementation thanks to his own positive interest in the clinical information system. However, he did not have enough time for these activities due to his main job.

Remedial measures:

In line with the change management principles, it is necessary to secure that a project manager is appointed from the part of the Hospital that would possess sufficient powers. The reason is in the fact that the supplier´s project manager possesses no powers toward the Hospital.

The project manager from the Hospital shall be responsible above all for the personnel management of the team, supervision of implementation works, and solution of all problems during the project. He will also supervise the communication and proper collaboration of all involved parties, in order to contribute to a smooth progress of the whole implementation.

Delayed supply of workstations to the wards

Substitution of paper documentation by electronic one requires placing a separate computer next to each bed. This was the reason why the number of existing computers had to be increased. Due to bad organization of work, the supply was delayed.

Remedial measures:

This barrier relates to the mentioned organizational deficiencies. Scheduling of deliveries must be better organized by Hospital´s IT department.

Staff information deficiency during the whole implementation

The health care workers were not informed in time about the implementation and its course. The staff were not informed about the causes of the delay of the implementation, about the time of launching real operation. They were not provided with user´s manual early enough before the start of routine operation. It was not provided for the feedback from users.

We evaluate this barrier as a very serious one. The change management capacities accent communication of all involved parties in the team. This barrier caused the negative attitude of health care workers to the CIS information system, and made their work conditions much more unpleasant.

Remedial measures:

This issue must be paid increased attention during further implementation. It is possible e.g. in the form of regular workshops in the form of a discussion accessible to all workers. This way, the staff can learn all necessary information about implementation. It is necessary to make written report from each workshop that will be available to those who were not able to take part in the workshop, and are interested in information.

It is very important to secure a support of top managers that have to take into consideration views and comments from end users, and apply them in the project.

Insufficient support and communication from the part of Hospital´s technical department

The insufficient support from the Hospital´s technical department manifested itself most during the real start of system operation. As follows not only from the survey, physicians and nurses had to face the real operation of the CIS information system in the first days alone, without active participation and assistance of a worker from the technical department. This situation affected negatively the work environment in the Department.

Remedial measures:

It is necessary that a worker of the technical department was present in the Department during the real start of the operation. It is recommended to nominate a particular technical worker who would be available in the Department first 14 days of real operation. This worker would be responsible for support and assistance to the health care staff, for solution of problems that would appear in the real operation, and he/she would look after a smooth launch of the clinical information system. His role would follow in the next weeks in a form of a consultant, who would search seriously for the lack of clarity, and who the users of the system would approach at any time.

8 Conclusion:

As was mentioned above, this is the first implementation of the clinical information system in the Czech Republic. This paper identifies barriers that shall be avoided in the next implementation. If the identified problems were avoided, the whole implementation could be quicker, and end users could work more efficiently.

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