

**Evaluation and assessment of a
generic computerized patient
record system utilized by physical
therapists in a primary care
setting**

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setting**

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I certify that all material in this dissertation which is not my own work has been
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Abstract

Within the field of medical informatics, patient medical records are the sole source of information for dealing with clinical activities concerning the documentation, care, progression, and ongoing interactions between the patient and clinicians. Electronic or computer-based patient records (CPRs) have had a presence within health care in some form and magnitude for the past thirty years yet only recently have been incorporated in health care to a larger extent. Due to the wide variation of professions in health care, there is a problem of CPRs not being able to fulfill all the possibilities and demands the individual professionals need, since many CPRs are designed as a generic system, to be used across multiple professions.

The focus of this report is on the utilization of a generic CPR in a specialist clinical setting, i.e., a physical therapy clinic, and to analyze how the therapists utilize the different components and features in a generic CPR. The purpose of the evaluation was to investigate how viable the CPR was as a documentation tool and to which extent it supported the therapists in their clinical, documentation and delivery of care activities. In this study, a total of seven physical therapists participated in a post-usage evaluation of an existing CPR. The evaluation was achieved by interpretative research with open-ended interviews and observations. The results of the study showed that despite some shortcomings, the generic CPR was an effective tool for the clinicians, not only as a documenting aid, but also enabling them to quickly research the patients' prior diagnosis and treatment history, plan for future care, support decision-making and to communicate with other professionals so as to coordinate treatment and planning.

Keywords: computer-based patient record, electronic medical records, generic, post-usage evaluation, physical therapy, the 2G method.

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1 Introduction

Health care organizations can be seen as large heterogeneous networks where people, tools, organizational routines, documents and different clinics, are all integral parts of the network (Berg, 1999). The roles, tasks and operations of the clinical specialists are tightly interwoven and often dependent on each other, resulting in the communication and the exchange of information between the actors as a vital part of providing patient care and service (Berg, 1999). Since health care is very information-intensive, the integration of computers as a part of health care informatics is seen as a necessity to efficiently improve health care organizations (Austin and Boxerman, 1999).

Information technologies allow for health care networks to effectively link and coordinate the various collaborating entities providing for large amounts of data and information to be processed, assembled and more easily overviewed (Berg, 1999). This results in obvious technological advantages over traditional paper-based documents, for example, easier and faster access to data and information as well as reduction of physical storage space (Ammenwerth *et al.*, 2003; Berg, 1999; van Ginneken, 2002).

Information processing is a vital component within the field of health care. Its prominence is discernible due to the immense amount of data and information that is processed in the daily activities of health care professionals (Berg, 1999). Health care informatics is more than just information processing in health care, but instead is an intersection of several sciences; information science, medical science and computer science (Åhlfeldt, 2001, p. 14).

Within the scope of health care, the processing of information and data relevant to medical science is often referred to as medical informatics which has been defined as “the application of computers and communications to medicine.” (Ball and Collen, 1992, p. 6)

In medical informatics, patient medical records are the sole source of information for dealing with the current status and activities concerning the care, progression, and ongoing interactions between the patient and clinicians (Kaihara, 1998). Electronic or computerized medical records have had a presence within health care in some form and magnitude for the past thirty years (NOMESCO¹, 1988) yet only recently have they been incorporated in health care to a larger extent (Holbrook *et al.*, 2003). The increasing presence of information technologies and computers in health care is influencing decisions to replace and/or compliment traditional paper-based documentation with computerized patient records (Beuscart-Zephir *et al.*, 1997).

The contents in a patient computerized patient record do not differ much from paper-based records (van Ginneken, 2001). The data is often divided up into two components, the personal data and the medical data (Ueckert *et al.*, 2003). Both are relevant to the patient’s medical record since they provide a background for the patient’s current situation (O’ Sullivan and Siegelman, 1997). The medical data generally consists of out

¹ NOMESCO = Nordic Medico-Statistical Committee

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patient data (past and present diagnoses and conditions), medications, laboratory tests and reports, follow-ups and treatment progression (Ueckert *et al.*, 2003).

There exists a multitude of names that refer to electronic medical records. Some of the more common names used in health care and research are: computer-based patient records, computerized medical records, electronic health records, electronic medical records and electronic patient records. van Ginneken (2001) effectively defines a computerized patient record in general terms as a non-paper patient record that may encompass several different media including, but not limited to, digitally entered text, scanned text and images, fully coded data, and other forms of electronic information compiled from various clinicians, departments and institutions. Kaihara (1998) defines a computerized patient record to

“literally mean a medical record stored in a computer as digital data, but it implies that the data are stored with a creating structure so that they can be easily retrieved when they are needed.” (p. 1)

The focus of this report is on the utilization of a generic computerized patient record in a specialized clinicians, that is, physical therapists, in a primary health care setting.

1.1 Overview of the dissertation

The contents of this dissertation are presented in the following manner: In the next chapter a thorough description and background of computerized patient records in health care will be given. In chapter three the problem with the aims and objectives will be defined. Chapter 4 will present and argument the choice of method and in chapter 5 a description will be given of how the method was initiated in the setting as well as the actors involved. Chapter 6 will give a thorough account of how the evaluation and assessment was carried out. The results will be presented in chapter 7 and analyzed in chapter 8. In chapter 9 conclusions will be drawn and discussed as well as possible ideas for future research and the chapter will then close with some reflections by the author on aspects of the project such as the method application and the evaluation results.

2 Background

In 1991 the Institute of Medicine (IOM) in the United States, constituted a recommendation that health care practitioners should adopt computerized patient records (CPRs) as the standard for medical record documentation and all other aspects of patient-based and clinical information processing (van Ginneken, 2001). Following the IOM recommendation of CPRs in 1991, the institute proceeded to establish a public and private sponsored initiative, the Computer-based Patient Record Institute (CPRI) to investigate the feasibility of obtaining the goals of the 1991 study (Dick and Steen, 1991). The CPRI mission helped to spawn the wide scale integration of CPRs within health care in the United States (Ball and Collen, 1992). In Sweden, SPRI² (1998) cites the main objective with computerizing certain aspects in an organization, such as information processing, was to increase effectivity. The SPRI report corroborated the American IOM study from 1991 by also recommending that CPRs eventually should phase out the use of traditional paper-based patient records. In Hong Kong, Ho *et al.* (1999) recommends that in the future computerized records should entirely replace paper-based records and that all clinicians should have direct access to the computerized records.

CPRs are now standard features in many modern health care facilities since they provide health care professionals with multiple benefits (DeLuca and Cagan, 1996) such as providing the clinicians with effective decision support, alerts, reminders, interpretation, assisting, analyzing, diagnosing, administration managing, and other aspects concerned with the provision of health care services (Hannan, 1999; Holbrook *et al.*, 2003). In short, CPRs make it possible to reduce administration time and increase access to other health care institutions and clinical databases as well as tapping into technologies that can be integrated in the CPR, such as various applications for processing text and image documents, e-mail and the Internet.

Within health care, there are many different professional and organizational groups that are involved in delivering health care to patients (Anderson, 2002a). Because of these differences, the groups are interdependent, yet simultaneously they are often reliant on sharing the same information and resources. Communication between the groups is mostly based on and around the patient record and new information technology. Thus, a CPR becomes the focal point and tool for enhancing this communication (Anderson, 2002a).

More often than not, CPRs are designed to cover all aspects of health care professionals, e.g., physicians, laboratory technicians, nurses and rehabilitation therapists, and clinical administrative personnel (Anderson, 2002a; Hannan, 1999). Since there is a wide variety of settings where health care is performed, such as hospitals, primary care and home health care, each sector has its own special needs and requirements based on specific operations and management control (Austin and Boxerman, 1999).

² SPRI = Social and Health care Planning and Rationalization Institute (in Swedish: Sjukvårdens och socialvårdens planerings- och rationaliseringsinstitut). Since 2000, SPRI is referred to as the Health Care Development Institute (in Swedish: Hälso- och sjukvårdens utvecklingsinstitut).

2.1 Role of CPRs in health care

The original idea of CPRs was to compliment paper-based records; attempts were made to use them parallel with each other, but these efforts resulted in records that lacked consistency (Mikkelsen and Aasly, 2001). Instead, the goal shifted to the CPR as replacing paper-based records entirely (Beuscart-Zephir *et al.*, 1997; Dick and Steen, 1991; Ho *et al.*, 1999; Lehoux *et al.*, 1999).

Lehoux *et al.* (1999) describe the CPR as having two objectives: firstly, by replacing the traditional paper-based patient record so as to provide more efficient communication and coordination between health care providers, and secondly, by exploiting information and data, i.e., support clinical utilization of information. These objectives and the general idea of the CPR in clinical contexts are shown in Fig. 2.1.

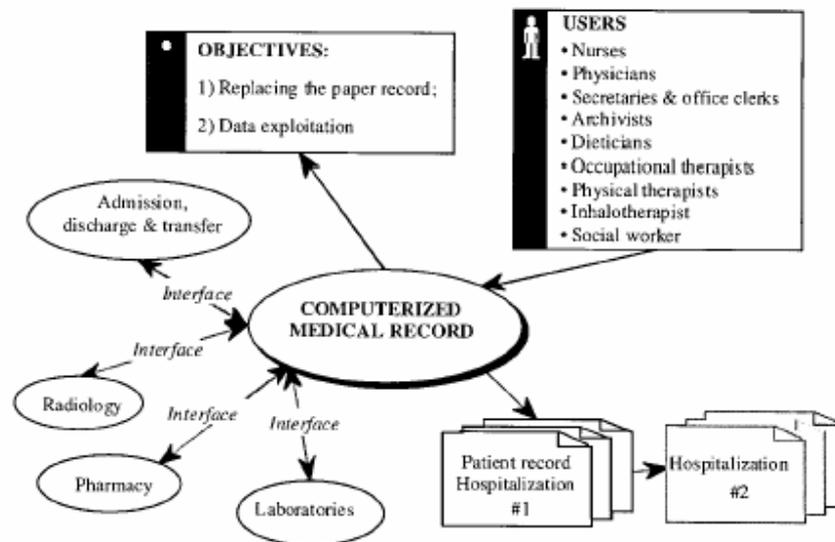


Figure 2.1. The computerized medical record as depicted by Lehoux *et al.* (1999, p. 443)

Not only does the CPR support information management and tools that assist in providing patient care, it also is a communication and research tool (Hannan, 1999). Furthermore, the CPR has an important role in organizational decision making, provides feedback for decisions concerning healthcare delivery and is an important tool for evaluating health care services (Hannan, 1999).

2.2 Advantages and disadvantages of CPRs

Technological advances in computerized health care information systems provide a wide range of benefits. These go far beyond the direct access to state-of-the-art clinical knowledge such as timely, up-to-date patient information and decision and diagnosis support systems (Ammenwerth *et al.*, 2003; Wang *et al.*, 2003). Further evidence shows that modern information technology can reduce errors made in clinical practice as well as to increase the efficiency of care and the possibility to improve the quality of provided patient health care (Ammenwerth *et al.*, 2003; Wang *et al.*, 2003).

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Patient data in medical records are retrieved, analyzed, supplemented and repositied repeatedly and thus, electronic mediums have proven to be more efficient and less cumbersome than traditional paper-based records (Ueckert *et al.*, 2003). Even though there is great optimism among the proponents for CPRs, they also take care to note the disadvantages that come with CPRs (Kaihara, 1998). The most common arguments for and against CPRs are shown in Table 2.1.

Table 2.1. Advantages and disadvantages of a CPR as opposed to traditional paper-based records, according to Kaihara (1998, p. 3)

Advantages of CPRs	Disadvantages of CPRs
Efficient access to the medical records.	Difficulty in data input especially images, hand-written sketches etc.
Easy generation of required documents.	A large scale information system required especially for image data.
Advanced information and decision support to clinicians.	Uncertainty of electro-magnetic, long term storage devices.
Small size of physical storage space.	Necessity of devices for reading.
Easy conversion of data into various documents.	More cautions required for data security.
Efficient collection and analysis of the medical record data for administration and clinical research.	Difficulty in standardization to obtain expected effectiveness.
Efficient data exchange among medical institutions.	

Ueckert *et al.* (2003), maintain that the advantages outweigh the disadvantages and see the implementation of CPRs as twofold: faster and more extensive communication of patient data between clinicians, departments and institutions as well as integrating patient data within electronic records. Thus, the CPR makes information more visible and accessible for all involved care providers of the patient, and for the patients themselves.

2.3 CPR users

As mentioned earlier, CPRs are used by most professionals in health care, from physicians and specialist clinicians to administrative personnel. In order to limit the scope of this study, it was deemed prudent to confine the users to be studied to a homogenous group of CPR users, i.e., users having the same tasks and use for the CPR. Before commencing on to the method and initiation of the evaluation, it is therefore necessary to present the role and definition of the CPR users in this study, i.e., physical therapists.

The domain of physical therapy is a part of the Therapeutic subsystem of the overall patient care system (Austin and Boxerman, 1997). The physical therapist (PT) evaluates patients, develops treatment plans and goals, and administers or supervises treatments (O'Sullivan and Siegelman, 1997). The PT also delegates portions of a treatment program to supportive personnel, e.g., physical therapist assistants (PTA) and supervises and

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directs supportive staff in designated tasks. The PT is responsible for re-evaluating and adjusting the plan of care as appropriate to changes in the patient status. When treatment of the patient is terminated, the PT performs a final evaluation and establishes a follow-up plan. All physical therapy and PT activity surrounding the patient is documented after each therapy session and assessment (O'Sullivan and Siegelman, 1997, p. 215).

A more detailed description of the PTs' activities will be portrayed in Chapter 5 where the setting of the study will be outlined and the PTs' current practice will be established.

2.4 The patient record

The objective of the patient record is to achieve patient-oriented quality in the delivery of care, i.e., delivering reliable treatment to the right patient at the right time and at the correct locale (Rigby, 1999). The reasons for keeping a patient record are multiple. Among the most important, are establishing a guidance system that documents patient history, current status, treatments and goals, as well as the methods used to achieve them (Kaihara, 1998; O'Sullivan and Siegelman, 1997). The records provide a memory aid for the patient and clinicians but also a support structure to enable professionals to make clinical decisions to determine whether treatment is appropriate and effective (O'Sullivan and Siegelman, 1997). Not only do the records provide information regarding the patient, but also pose as a record of clinical and hospital activities and for administration, education and research (Kaihara, 1998).

The medical patient record can be seen as the core of medical informatics by providing information for documenting clinical activities of both patients and clinicians (Kaihara, 1998). The focal point of the patient record and how other clinical activities are interdependent on it, is shown in Figure 2.2 as described by Dahlin and Arnesjö (1996).

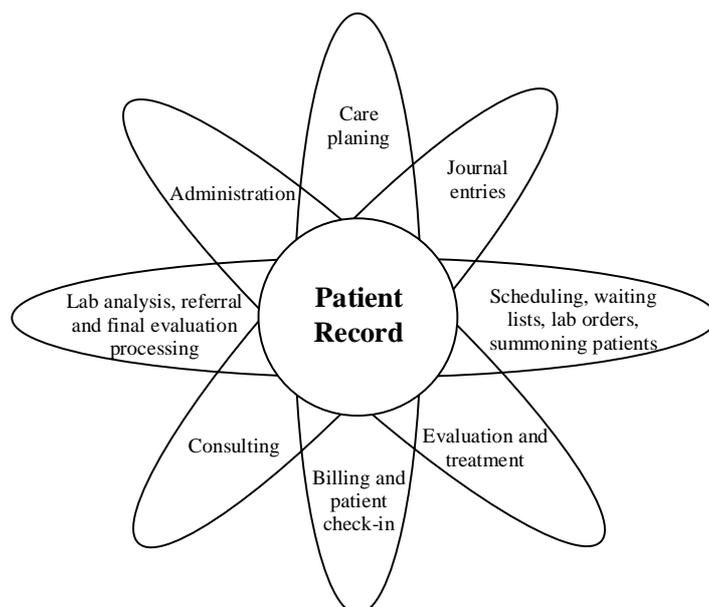


Figure 2.2. Clinical activities comprising the Patient Record, after Dahlin & Arnesjö in Peterson & Rydmark (Eds) (1996, p.106).

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2.4.1 Documentation formats

The most widely accepted procedure for recording patient records is the Problem Oriented Medical Record (POMR) (O'Sullivan and Siegelman, 1997). As the name suggests, it is problem oriented, focusing on the patient's problem, diagnosis and status. POMR is a record system for recording clinical notes in a chronological order. The POMR procedure includes the Subjective, Objective, Assessment, Plan (S.O.A.P.) format. In short, subjective information is gathered from the patient or family member; objective measurements are made by a clinician obtained from an examination; an assessment of the analysis of the problem is done, including long and short term goals; and lastly, a plan of a specific treatment for the identified problem is prepared. S.O.A.P. is not only used for the benefit of the clinician, other health care professionals and the patient, but also for administrative, insurance and legal institutions as well as national boards of health care (O'Sullivan and Siegelman, 1997).

All entries in the CPR are done in chronological order, including clinical notes in the S.O.A.P. format (O'Sullivan and Siegelman, 1997; van Bommel and Musen, 1997). Another format for keeping patient records is source-oriented (van Bommel and Musen, 1997). This format is also chronological and is used to show clinical activity from different sources, such as X-rays, lab reports, etc that are included in separate sections of the patient record and used as supplements to the patient record (van Bommel and Musen, 1997).

2.4.2 Physical therapy requirements

According to O'Sullivan and Siegelman (1997) a patient record written by a physical therapist is expected to have the minimum features shown in Table 2.2 below.

Table 2.2. Documentation features and description for PTs according to O'Sullivan and Siegelman (1997, p. 207).

Feature	Description
Initial Evaluation/Consultation	Observations and patient interview
History	From the patient, previous record entries, physicians or other clinicians.
Objective findings	Therapist's own observations.
Assessment	Diagnosis and/or current problem assessment and short and long term goals.
Treatment plan	Current and future types of treatment to be implemented.
Progress notes	Patient status and treatment after each visit.
Re-Evaluation/Summary Progress report	Evaluations done within thirty days for new status and treatment assessment.
Discharge Summary	States reasons for treatment termination, results and patient status at time of discharge plans for further action.

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Other general requirements for documentation are written referrals from physicians or other health care providers or from the patient themselves, as well as forms recording measurements (O'Sullivan and Siegelman, 1997; Ueckert *et al.*, 2003). All records must provide the patient's name, social security or ID number, address, date of entry and signature of the care givers (O'Sullivan and Siegelman, 1997). Documentation always includes patient status and response to treatment as well as progression reports. Other events are also expected to be recorded, such as phone conversations with the patient, relatives and other clinicians, etc. Lastly, a discharge plan and summary is recorded when goals are reached or treatment is terminated (O'Sullivan and Siegelman, 1997).

2.5 Issues of acceptance and implementation of CPRs

As is true with other IT systems, the influx of CPRs in health care hasn't come without pitfalls (Hannan, 1999). Berg (1999) calls attention to previous studies that have shown that up to 75% of large IT systems in use should be considered as operating failures, that is, they are too cumbersome, expensive and lacking in functionality to be considered a "success". SPRI (1998) observed a trend in Sweden matching those seen in other industrialized countries; the health care sector has been lagging with the implementation of IT systems, as compared to other industries and facets of society. Due to this sluggish approach of implementing information technologies in non-administrative sectors of health care, the results from 1998 showed that a large number of health care workers in Sweden lacked sufficient computer skills and knowledge when computerization expanded into the field of patient record documentation (SPRI, 1998).

2.5.1 User acceptance

Ammenwerth *et al.* (2003) concluded that the success of a CPR in health care is largely dependant on how the system corresponds with the clinical workflow, how the technology is introduced, quality of training and support and on the motivation of the users. In addition, Beuscart-Zephir *et al.* (1997) demonstrated the necessity of taking into account the cognitive aspects of the users since they play an important role in the usability of the applied technology.

The introduction of CPRs in a workplace forces the users to change their work routines, and in the early stages a significant amount of time is needed for training and educating the users how to use the system (van Ginneken, 2001). This can add a degree of frustration and skepticism from the users and influence their acceptance of the system and their desire to use it. This is important to observe and know since commitment and acceptance by the users is of utmost importance in shaping the success of the implemented system (van Ginneken, 2001). It has widely been noted that younger clinicians often tend to grasp and accept the new technologies much faster than their older colleagues, since the younger people are often more exposed to computer technology and familiar with typing and navigating within software applications (Ammenwerth *et al.*, 2003).

A major issue that negatively influences user acceptance is the utilization of a system that is not specifically designed for the task at hand or a system that has a high degree of non-usability for the users (Ammenwerth *et al.*, 2003; Hannan, 1999). User acceptance and

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satisfaction is highly dependent on good design and reasonable cognitive load (Ammenwerth *et al.*, 2003). Olausson and Åkesson (2003) reviewed studies that have shown that the use of computer systems is highly dependent on user acceptance and proficient education in use of the application. In their own study, Olausson and Åkesson (2003) analyzed the utilization of CPRs by nurses in Swedish hospitals and came to the conclusion that user training, reduction of workload and support are crucial factors for the implementation being successful. Other important factors that Olausson and Åkesson (2003) found to be prerequisites for user acceptance of the CPR, were the users' familiarization with computers, adequate education of the CPR software and post-implementation follow-ups. Aside from deficient general computer skills, Ammenwerth *et al.* (2003) observed that the extra time needed for education of the software lowered motivation to use the CPR since it infringed upon the effective clinical work hours. Lastly, technical glitches and delays were an obvious source of user frustration and dissatisfaction (Ammenwerth *et al.*, 2003; Hannan, 1999).

2.5.2 Implementation issues

For all the advantages CPRs provide and problems they solve, there are disadvantages and new problems that naturally arise when implementing a CPR system. Most CPRs have shown, at best, to only partially reach the necessary requirements, and thus leave the CPRs from reaching their full benefits (van Ginneken, 2001). Aside from technical and administrative problems, an additional problem that can incur is the time consuming educating of all health care professionals on how to use the system (Ammenwerth *et al.*, 2003; Hannan, 1999).

Since most CPRs focus on either primary care or hospital settings, compatibility issues or problems accessing separate databases and networks can arise and can be an issue if there is an exchange of information between heterogeneous networks and databases, for example, between hospital and primary care networks. (Nielsen *et al.*, 2000). Anderson (2002a) notes that since communication is so vital and common amongst professionals in health care, it can directly affect the adoption and integration of a CPR in the workplace. Since there exists such a tight communication and common sharing of resources, the introduction of a CPR alters policies and procedures and work routines as well as the interactions between the different professional and organizational groups. This socio-technological network of interaction and communication plays an important role in the outcome of the usability of the system (Anderson, 2002a).

Futhermore, Ammenwerth *et al.* (2003) point out that modern information systems are costly to purchase and maintain. Implementational, functional and technological failures can have serious consequences and cause negative effects on the patients and staff (Ammenwerth *et al.*, 2003). Aside from cost factors, just the immense undertaking of an implementation of a CPR in a hospital can be disrupting and cause delays and frustration for patients and clinicians and it can take months to adjust the stakeholders to the new routines (Lehoux, 1999).

Another issue surrounding the implementation of CPRs is the different interests of the stakeholders. Conflicts of interest among the users of an IT system or CPRs stem from

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the fact that the different stakeholders that use the system can hold different views on the success of the system (Ammenwerth *et al.*, 2003; Berg, 1999; Hannan, 1999). In health care, there is such a wide scope of professional roles that it is natural that different conceptions of the viability of a system arise (Hannan, 1999). Different professional groups can see the technology as a way to achieve their conflicting goals, and thus a group's view of the "right" technology and functionality will not be shared by all stakeholders (Berg, 1999). For example, clinical specialists strive after an easy to use system that supports information retrieval and documentation tasks, whereas administrators demand a system that ensures that organizational and legal documentation are upheld (Ammenwerth *et al.*, 2003).

Berg (1999) explains that another problem with IT systems and the introduction of CPRs in health care is that information processing in health care, i.e., medical informatics, has a "messy" nature since it is highly influenced by human, social, behavioral and cognitive contexts. Berg (1999) argues that this is a substantial reason why problems exist when transforming the soft system methodology of the health care informatics domain into the hard, rigid, structural and rational confines of an IT system.

2.6 Evaluation approaches

Since the field of medical informatics is complex due to the organizational settings they are implemented in, traditional experimental methods for evaluating the technologies are often not practical to use in most cases when doing post implementation evaluations (Anderson, 2002b). Ammenwerth *et al.* (2003) indicate that research in the area of evaluating IT systems in health care is still in its infancy, and as of yet, it is still unclear what the definition of a "good" health care IT system is. An evaluation requires a critical assessment of the technology (Lehoux *et al.*, 1999) but also a detailed analysis of the cognitive aspects of the system relating to the users as well as the user requirements (Besucart-Zephir *et al.*, 1997) and the attitudes and roles of the users and the utilization of the technology (Anderson, 2002a). These different aspects as well as the approaches and problems with evaluating CPRs are presented in the following section.

When evaluating an IT system in health care, there are several important questions to be asked. Rigby (1999) postulates that there are three vital questions for an evaluation that should be the center of attention. (1) Does the CPR enable the clinician to obtain a better view of the patient? (2) What effect does the inter-professional sharing of resources and records lead to – cooperation or conflict? (3) Does the CPR lead to the acquiring of new professional skills or the loss of necessary previously acquired skills?

Rigby (1999) means that the above questions are derived from three categories which should be the focus for evaluating medical informatics applications. The categories comprise the technological assessment (Lehoux *et al.*, 1999; Anderson, 2002b), human sciences and psychology (Anderson, 2002a; Anderson, 2002b; Beuscart-Zephir *et al.*, 1997; Beuscart-Zephir *et al.*, 2001), and the social science (Coombs *et al.*, 1992) approaches. Most evaluations of health care informatics systems focus on one or more of the above, yet Rigby (1999) stresses that a complete evaluation must include all of those aspects. As far as the technical aspects of an IT system are concerned, such as user

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interfaces and functionalities, they can be evaluated prior to implementation using traditional experimental and modeling methods of evaluation, but for post evaluation other approaches are necessary since other factors are involved (Anderson, 2002b). For example, it is necessary to be able to understand and evaluate the patterns of relationships among the organization members, instead of limiting the evaluation to just the technological aspects (Anderson, 2002a).

On the other hand, Beuscart-Zephir *et al.* (2001) deem it necessary to conduct a precise analysis of user activity so as to identify the cognitive constraints that influence usability and acceptance of the application. In accordance with this view, Ammenwerth *et al.* (2003) stress that attention must be given to facets that affect the users, such as cognitive load, functionality, and usability. Ammenwerth *et al.* (2003, p. 126) pose these aspects as questions of importance that should be observed when evaluating an IT system in healthcare:

- What is the usability of the information technology?
- Do the users accept the information technology and use it as intended? If not, why not?
- How does the information technology affect structural or process quality (time saving, data quality, clinical workflow, patient administration) with regard to different users (physicians, nurses, administrative staff)? Does it work effectively? If not, why not?
- What are the effects of an information technology on the quality of care?

Besucart-Zephir *et al.* (1997) stress the importance of user requirements in the context of the implementation, arguing that:

“As user requirements are the norm for the evaluation process, their content has to be extended: User requirements must include an expression of fundamental constraints linked to main features of users’ activities and tasks.” (p. 22)

That is, a task model must be built so as to assess how the user acquires information and processes it. Furthermore, the authors identify what they consider vital steps for a cognitive evaluation: 1) identifying goals, tasks and subtasks and what strategies are used to perform them, 2) modeling the activity of the user and 3) describing future activity supported by the new tool (Besucart-Zephir *et al.*, 1997, p. 27).

Lehoux *et al.* (1999) note that evaluators can encounter problems of a partly technical and partly social nature, which can make them difficult to solve. Not being able to discern the design flaws from user behavior, such as resistance, motivation and limited computer skills etc, makes it difficult to pinpoint what the exact cause of the problem is (Lehoux *et al.*, 1999).

2 Background

Lehoux *et al.* (1999) used the Actor-Network Theory (ANT) evaluation method to examine the change in actors' behavior during the development and utilization phases. ANT made it possible to examine how these behaviors are related to certain technical features. According to Lehoux *et al.* (1999) the advantage of ANT is that it emphasizes the networks of humans and technologies and how a certain technology obtains its meaning from problematic situations and by the way users utilize the features, modify and influence the problematic situation. In such a way, ANT is effective for evaluating a system before development is finalized and modification is still possible (Lehoux *et al.*, 1999).

Anderson (2002a) used a similar approach to the ANT employed by Lehoux *et al.* (1999) by employing social networks to identify relationship and behavioral patterns within and between the different occupational groups that make up the users of the same system. The idea was to analyze the effects that the patterns had on the users' behavior and performance in relation to the technology and the users (Anderson, 2002a). Furthermore, Anderson (2002a) argued that the social network approach can be used to obtain a better understanding of changes in communication patterns and similar interactions between the users. Another socio-technical evaluation approach, similar to Anderson's (2002a), was presented by Coombs *et al.* (1992, p. 56). They suggested that the evaluation should be done along two perspectives, the first centering on the distribution and flow of information. The second perspective focused on the contents of the information and how it is interpreted and the consequences within the organization.

Anderson (2002b) used computer simulation to model and evaluate performance of a CPR in a complex system situation. He described this method as appropriate for evaluating information systems prior to installation and where it is possible to evaluate alternative system configurations. Simulation can also be used to discover improvements in an existing system where traditional methodologies would be too difficult or costly to use (Anderson, 2002b).

Rigby (1998) stresses the importance of evaluating CPRs at the appropriate time and not assuming that evaluations end after the implementation phase. In order to understand the effects of the system on the users, their work and the organization, it is therefore necessary to implement post-usage evaluations (Anderson, 2002a; Anderson, 2002b; Besucart-Zephir *et al.*, 1997). Evaluation is an ongoing process and a continuous assessment of a CPR should be done on a regular basis, not only during the implementation phase, but also post implementation to ensure that the system is reliable (Mikkelsen and Aasly, 2001).

3 Problem

Due to the previously stated wide variation of professions in health care (Chapter 2), there is a problem of CPRs not being able to fulfill all the possibilities and demands the individual professionals need, since many CPRs are designed as an amalgamated system, i.e., a generic system, to be used across multiple professions (Hannan, 1999). Reasons being for this type of design are, among other things, high cost of tailor-made designs, ignorance of differing needs of clinicians and policy constraints. Basic services, such as the patient database, messaging, decision support, etc. are provided for, but profession-specific aspects are often missing, deficient, time-consuming to implement and educate, or difficult to grasp and comprehend (Hannan, 1999).

Even though CPRs have been around in health care for a number of years, there is little research done in the evaluation of implemented CPRs (Ammenwerth *et al.*, 2003) and regarding the impact that this technology has for the users, i.e., the clinicians (Holbrook, *et al.*, 2003). Furthermore, Anderson (2002a) revealed that there is a wide misunderstanding regarding the process by which information technologies are used in medical settings and that further evaluation of the technologies is needed to better understand, integrate and exploit the benefits of IT in health care. Moreover, as CPRs increasingly aid the management of medical information, some specialists desire tailor-made applications to support their clinical activity (Beuscart-Zephir *et al.*, 2001). Therefore it is of interest to study how well generic CPRs support specialist clinicians with their documentation and clinical tasks.

3.1 Aims and objectives

The aim of this dissertation is to analyze how the users utilize the different components and features in a generic computerized patient record system (CPR) and why said components and features are utilized in the manner they are used. Moreover, the aim is to establish how the existing system supports the users and how it could more effectively support them in carrying out their clinical activities and tasks.

From the previously stated aim, the key objective of this study, and that which the primary focus is on, is identified and accounted forthwith as to:

- Identify the different features and functionalities of the system that users utilize and analyze *how* they are used and *why* the users use them in the manner they do.

Aside from the main objective of this study stated above, an additional objective, albeit of less prominence, is to:

- Assess and identify the users' perceptions concerning improvements that could make the CPR a more effective tool in assisting their clinical activities.

3.2 Scope of the study

The scope and limitations of this study are confined to a post-usage evaluation of a generic CPR that was not designed for a specific user group. Taking this into consideration, it was necessary that the user group being studied belonged to a profession that has specific clinical and documentation needs not specifically targeted in the design of the generic CPR.

This study is not intended to evaluate a CPR used by administrators, managers or other non-clinical personnel, but is instead focused on users who utilize the CPR as a tool to aid their clinical activities as well as for patient record documentation. Furthermore, the focus of the study is on aspects of the CPR that support care planning, journal entries access to test and lab results, referral and final evaluation processing, and evaluation and treatment documentation. Thus, physical therapists practicing in primary care, were seen as a profession that represented a group of clinicians with the above needs as well as specific requirements for documentation and clinical activity that were not specifically targeted by a generic CPR. Yet, it should be noted that there are many other professions in primary health care, such as occupational therapists, speech therapists and nurses, to name a few, that could just as well be deemed equally representative as the users in focus for this type of study.

4 Method

When a methodology is chosen to study a phenomenon and generate a theory, it is either of a quantitative or qualitative nature, or as a hybrid, that is, an integration of both (Starrin *et al.*, 1997). Quantitative methodology produces theories through the collection of data that is statistically representative (Starrin *et al.*, 1997) while qualitative data is comprised of words or pictures, rather than numbers and statistics (Seaman, 1999). Since this study focuses on the socio-technical aspects of an IT system in a complex organizational setting, a qualitative approach is the natural choice since it is a systematic approach of obtaining knowledge and defining the nature, condition or quality of something (Starrin and Svensson, 1998). More importantly, qualitative research helps to interpret research in the social sciences, or other areas of study that are difficult to understand or hard to measure statistically (Maxwell, 1996; Starrin *et al.*, 1997; Starrin and Svensson, 1998) and offer a means for obtaining knowledge from areas that have dimensions and relationships not suitable for quantitative methods (Starrin and Svensson, 1998). Therefore, the focus of this section is on defining the appropriate type of qualitative methodology for this study and the motivation for choosing it.

4.1 Qualitative research

Qualitative methods present good possibilities for broad-mindedness and tolerance. Maxwell (1996, pp.17-20) explains the strengths of qualitative studies by presenting five primary purposes for research:

1. Understanding the meaning of events, situations and actions participants are involved in, from their perspective.
2. Understanding the context within which the participants act in the influence the context has on their actions.
3. Identify unanticipated phenomena and influences and generating new grounded theories of the influences.
4. Understanding the process by which the events and actions take place.
5. Developing causal explanations.

According to Maxwell (1996, p. 21), the practical purposes of qualitative studies are to (1) generate results and theories that are understandable and credible, (2) conduct formative evaluations used to improve existing practice and (3) to engage in collaborative or action research with practitioners or research participants. Thus, complex fields such as the human and social sciences, can be studied by using an inductive, open-ended strategy by deploying participant observation (Seaman, 1999), in-depth interviews, and action research (Orlikowski, 1993; Maxwell, 1996; Starrin *et al.*, 1997; Starrin and Svensson, 1998; Seaman, 1999).

4 Method

4.1.1 Research strategies

Several different strategies for qualitative research exist (Orlikowski, 1993). Among these strategies, positivist, critical and interpretive (Orlikowski, 1993; Klein and Myers, 1999) are strategies that are of relevance for this type of study. Positivist research is viable if the phenomenon to be studied has formal propositions, quantifiable variables that can be measured and where inferences can be drawn from a represented sample of a population. Critical research is appropriate if the focus is on social critique, that is, the aim is based on revealing human potential constrained by social, cultural and political domination (Klein and Myers, 1999). Interpretive research, on the other hand, focuses on knowledge and understanding of the social, organizational and system contexts, obtained only through language, observations, shared meanings, documents and access to other tools within the context (Klein and Myers, 1999). Furthermore, Klein and Myers (1999) define interpretive research as a way to help researchers understand the thoughts and actions of humans in the context of social and organizational settings. Due to the social, organizational and technical context of this study, interpretive research is deemed to be the most appropriate fit for this study.

4.1.2 Grounded theory

When information and knowledge about a system are obtained by interviewing and/or observing the individual actors using the system, it is important that researchers consider the social context of systems and the intentions and actions of the key players (Orlikowski, 1993). In such situations, the Grounded Theory approach, developed by Glaser and Strauss (1967), is advantageous because it allows the researcher to focus on the social context of the system and aspects of human interactions influenced by the system (Orlikowski, 1993). Furthermore, theory generation is grounded and based on the collected data (Starrin and Svensson, 1998).

Grounded theory is an iterative methodology, that is, all processes and actions, e.g., data collecting, coding and analyzing, proceed iteratively with a constant movement between the data and concepts (Glaser and Strauss, 1967; Starrin *et al.*, 1997; Orlikowski, 1993; Maxwell, 1996). Since grounded theory has inductive, contextual and process-oriented characteristics, it conforms to the interpretive rather than positivist orientation of research (Orlikowski, 1993). Moreover, grounded theory has been extensively applied in studies focusing on evaluations within the fields of social sciences and health care (Starrin and Svensson, 1998).

4.2 Choice of method

Often, a qualitative study begins with a case study, where the purpose is to scientifically describe an organization such as an institution or a population (Marshall and Rossman, 1989). Case study research has several purposes, among others, to chronicle events, to give an interpretation of the studied object, and to examine and test (Guba and Lincoln, 1981). When evaluating information systems, there should exist a dynamic evolution of the process between stakeholders, the context and the evaluation activity, yet the stakeholder should have a central role in the evaluation context (Lundell and Lings,

4 Method

2004). A model of this concept is shown in Figure 4.1, where the evaluation process is represented as a cycle involving the stakeholders, context and evaluation activity (Lundell and Lings, 2004).

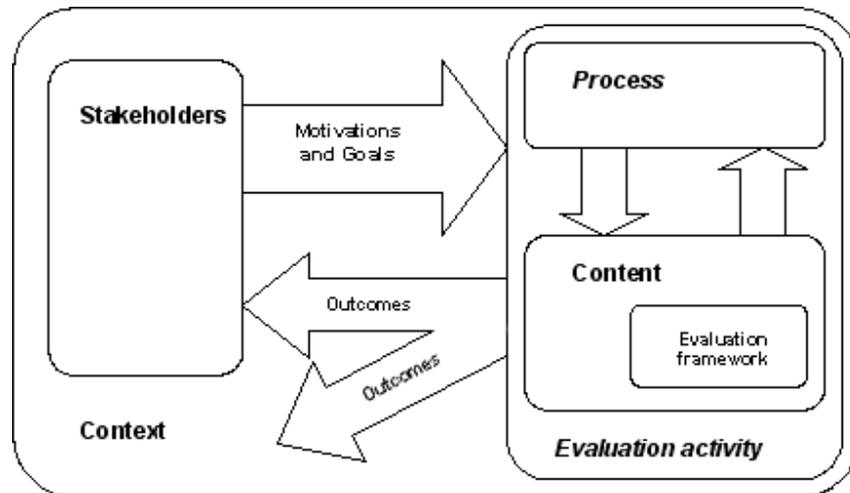


Figure 4.1. Elements of information systems evaluation as depicted by Lundell and Lings (2004).

The cycle for developing an evaluation framework is an evolutionary and dynamic process including the basic ideas of grounded theory, and thus is fundamental for any evaluation activity (Lundell and Lings, 2004).

The 2G method

The 2G method is influenced by grounded theory (Lundell and Lings, 2003) and due to this influence it acquires its name since it is “doubly grounded” in the data used to study the phenomenon. Grounded theory has an evolutionary process of building a framework where there is an iterative process between data collection and analysis (Glaser and Strauss, 1967). The 2G method, developed by Lundell and Lings (2003), inherits this aspect and was originally designed for deployment in pre-usage evaluations, specifically for evaluating computer-aided software engineering (CASE) tools. The 2G method has a socio-technical nature, and integrates both the soft and hard aspects of the context and the object targeted for evaluation. According to Lundell and Lings (2003), the method can be used in any situation where an IT product is to be evaluated. Recent studies have been done where the method has been implemented to evaluate other IT products (Hedlund, 1999; Zaxmy, 2003) and it has also been used as a post-usage evaluation method (Zaxmy, 2003).

The 2G method was deemed to be a reliable evaluation method for the context of this study and a good fit for studying CPRs in health care since it focuses on two perspectives: the contextual perspective and the technological perspective, that is, it addresses the “soft” social and organizational requirements as well as the “hard” technical aspects of evaluating IT products and successfully integrates these two facets to provide a substantial evaluating framework (Lundell and Lings, 2003). Furthermore, the

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method focuses on the complexity of human concerns and involvement, such as the perceptions of the stakeholders and the culture of the organization. Aside from covering the duality of socio-technical approach, the benefits of the 2G method are twofold: it establishes an evaluation framework that is unique for each organization, and it lends method support so as to enable effective implementation of an evaluation (Lundell and Lings, 2003). In Figure 4.1, the 2G method is represented as the evaluation activity.

The 2G method consists of two phases; a strategic phase and a pragmatic phase comprised of iterations where data is collected, coded and analyzed (Lundell and Lings, 2003). Data collection is often done by in-depth interviews, observations and/or by examining pre-existing documentation such as manuals (Rehbinder *et al.*, 2002). The goal of building a framework is to find indicators that can form concepts which in turn produce categories (Rehbinder *et al.*, 2002). The method process (Lundell *et al.*, 1999; Rehbinder *et al.*, 2002) is described in Figure 4.2 below:

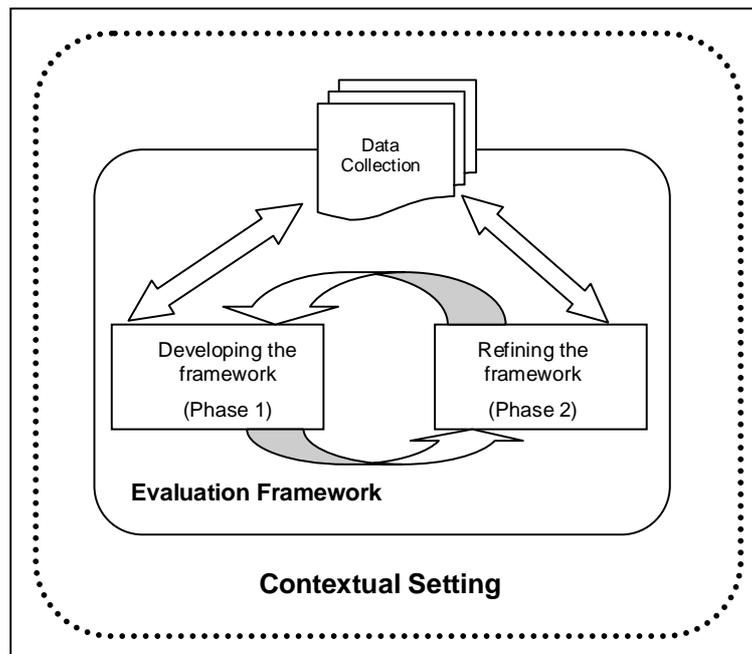


Figure 4.2. Description of the 2G method process after Lundell and Lings (2003).

As with most qualitative methods, the iteration between data collection and forming concepts is terminated when no additional data being collected can add to the concepts, and the categories emerged can sufficiently explain what has been observed (Orlikowski, 1993). The 2G method provides a structure and set of guidelines to assist in creating an evaluation framework, yet it should be noted that the method was implemented with a degree of flexibility and therefore differing slightly from previous implementations (Hedlund, 1999, Rehbinder *et al.*, 2002; Zaxmy, 2003) of the method. A more detailed description of how the method was applied will be given in the next sections.

5 Initiating the study

In this chapter an in-depth description will be given of the setting where the study was carried out, the actors involved, preparatory procedures upon entering the contextual setting of the study, and lastly, introduce the CPR that was deployed in the setting.

5.1 The organizational setting

The chosen setting for this study was the department of Physical Therapy in a primary health care clinic in a small town in southern Sweden. This setting was chosen since it met the requirements for addressing the aim of the study, that is, it incorporated clinical specialists utilizing a generic CPR. The department had seven fulltime practicing PTs who had been using the CPR system since 1999. Before the CPR was installed, all documentation in the medical patient records was paper-based and entered by hand or type-writers by the PTs themselves or secretaries. The PTs provide treatment to patients referred to them by the primary care physicians, nurses and occupational therapists at the same clinic, or by patients who directly contacted the PTs for consultation and treatment. A third source of referrals is from clinicians outside of the primary care region, such as neighboring counties and hospitals.

The PTs access the CPR through personal computer (PC) terminals connected to the primary care local area network (LAN). The PCs were equipped with Windows 95 and Windows 98 operating systems and used Novell as the network software.

5.2 Actors

The method user was previously employed as a licensed physical therapist and has five years of experience working with CPRs deployed in health care. This project was undertaken by the method user as a Master's dissertation in Computer Science at the University of Skövde.

The respondents for the study were made up of physical therapists who used the CPR in their daily clinical activities. The clinical expertise of the PTs in the department ranged from 4 to 30 years and all had at least 3 years experience with the department's CPR. Only two of the PTs had previous experience in using paper-based patient records, while the rest of the PTs in the study had only used CPRs in their work.

5.3 Entering the contextual setting of the study

Because of the method user's previous background in health care and physical therapy, the method user was already familiar with the organizational setting and the deployed CPR. Nevertheless, the method user spent time with the respondents and the members of the organization to get more familiarized with the current status of the organization and the CPR. Permission to undertake the project was granted by the supervisor of the Physical Therapy department. Shortly thereafter, at a staff meeting, the method user was introduced and the aims and objectives of the project were presented. The response of the PTs was positive and all of them were willing to partake in the study. Initially, three PTs were selected to participate in the first part of the study with an additional PT later chosen

5 Initiating the study

to participate in the observation part of the data collection. The selection was done by the supervising PT where names of the PTs were randomly drawn from a hat. For the latter part of the study, three new PTs were also randomly chosen for the remaining interviews. After the initial respondents were chosen, the method user met with them to discuss in more detail how the data collection would proceed and how long each interview session was expected to take. Furthermore, the respondents were notified that all personal information was confidential and all names and statements issued would be held anonymous. The respondents were informed that all tapes with recorded conversations would be destroyed once the data was transcribed and translated into English and that each respondent would be presented with a printout of their interview transcriptions so as to assure the correctness of the transcription. All the respondents agreed to the terms of the study and none of them had any objections or problems with the procedures.

The Profdoc CPR

The main requirements for the CPR system were (1) that it was designed as a generic system to be deployed by health care professions in different sectors of health care and (2) that the system had been implemented for at least a year so that the users were efficient at using it. The target CPR for this study is the Profdoc Journal III CPR made by Profdoc AB (2004). It was designed for use in a Microsoft Windows milieu and implemented in a network environment. At the time of this study, Profdoc had been in use by the users for five years, but over the years had been upgraded with minor improvements (Profdoc, 2004), none of which caused a problem for the familiarity of use for the users.

It was of interest for this study to examine the functions of the CPR that were relevant for the PTs regarding support for their daily clinical activities. The following functions supported by the CPR were employed by the PTs and thus deemed as important aspects of the CPR:

- Patient registration
- Searching patients and patient information and journals
- Retrieval of patient information
- Retrieval of patient documents such as X-rays, lab results, etc.
- Entering new patient status and progress notes
- Entering diagnosis and treatments
- Signing filed documents and text.
- Writing documents: letters, final evaluations, referral replies and evaluation summaries for third parties
- Messaging

Profdoc has other functions and capabilities such as administrative, statistical, scheduling and billing functions. The PTs had limited access to or no need to use the aforementioned functionalities and therefore they will not be accounted for in this section or in the evaluation.

5 Initiating the study

The program had two main points of entry, the Start Page and the Patient menu. Figure A1 in Appendix A shows the hierarchical structure with the functionalities of Profdoc. To gain access to the LAN and the CPR, all users must log onto the network first and from there they could then log onto the CPR. Each user had two passwords: one for the network and one for the CPR itself. Once the users had logged on to Profdoc, they were given access to the Start page (see Figure A2 in Appendix A). From here the users could choose to access a number of functionalities by clicking on the icon buttons for each function. By clicking on the Patient Records button, the users could register or search for patients by entering a patient ID number or name, or choose a current patient from the Recent Patients list. Once a patient is chosen, they are in the patient's journal and had access to several functions such as writing entries, searching among entries from PTs or other clinicians, and viewing filed documents such as referrals, evaluation summaries, X-ray and lab reports etc. For a more detailed description of the user interface layout, see Figures A2-A5 in Appendix A, which depict actual screen dumps from the patient record windows. Furthermore, all functionalities and features available in the CPR are shown in Table B1 in Appendix B.

6 Establishing the evaluation and post facto assessment

In this chapter, a description will be given of how the evaluation framework was developed and refined in the two iterations as well as the coding and analyzing process used to develop the framework. Later on in the chapter, a description of how the post facto assessment was established will be presented, and lastly, some reflections over the method application will be summarized.

6.1 Applying the 2G method

The process for developing and refining the evaluation framework is shown in Figure 6.1. The model depicts how the 2G method was slightly modified to fit the nature of the objectives for this study. The framework evolved by iterating data collection and analysis between the two phases when developing the framework (First Iteration) and then proceeding with coding and analysis before moving on to the refining of the framework (Second Iteration) where the procedure was repeated until the supply of relevant information was exhausted. Furthermore, the figure shows the focus for each of the phases.

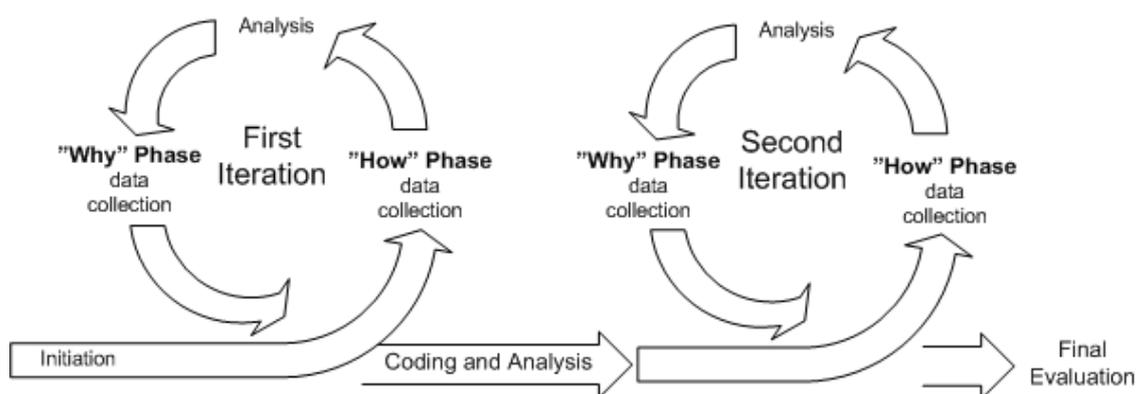


Figure 6.1. The procedure and flow of the processes for data collection, coding and analysis in the iterations and between the phases for each iteration.

For both iterations, the data collection consisted primarily of in-depth interviews, but was also complimented by viewing documentation and manuals for the CPR as well as onsite participant observations of the respondents as they used the CPR in their daily routines. The next sections describe in detail how the evaluation framework evolved out of the above process.

6.1.1 Developing the Framework – Iteration 1

The first iteration covered a time span of 17 days. The purpose of this iteration was to collect a substantial amount of information in order to develop a framework which would help to establish the PT's current practice and the use of the CPR in general. A total of three interviews were done during this iteration.

6 Establishing the Evaluation Framework

After the initial presentation of the project at the staff meeting, the method user contacted the participating respondents in order to book times for the interviews. One and a half hours for each interview was set aside. At the start of each interview, ten to fifteen minutes was used to inform the respondents about the procedure of the interview. They were told that the questions would be broad and open and that the respondents were encouraged to say what first came to mind and expound on their thoughts. The respondents were also reminded that everything they said would be held anonymous and that transcripts of the interviews would be made available for them to verify that the collected data was correctly interpreted and to reflect over the contents of their replies and explanations. It was also pointed out to the respondents that the data from the English translations would be used to develop the evaluation framework and excerpts from them would be used as examples in the report.

An advantage of using the English translations was that more anonymity would be provided since unique speech traits of a specific respondent could be harder to trace in the translation. This was seen as a positive effect so that the respondents would not feel their comments would be easily recognized by readers. On the other hand, there was a risk that the exact meaning and use of expressions to exemplify certain aspects could also be lost in the translation. For subsequent interviews with the same respondents, the session started out by discussing the transcript and the English translation, if viewed, of the previous session and asking the respondents for their reflections of the questions and answers. The actual question and answering session of the interviews lasted between fifty minutes and eighty five minutes.

During the first iteration, the three respondents participated in one interview session each. All interviews were held in the PT offices where a CPR was available and the PTs were logged on so as to show the method user examples or items that were hard to explain verbally but easy to show in action. In order to minimize distractions, the interviews were held in private, behind closed doors, with only the interviewer and respondent in the room. All sessions were taped with a micro-cassette recorder. Pen and paper were used if something was needed to be elaborated on, such as with a drawing or for the method user to take notes, or reminders for future questions. The structure of the interviews was very open and the respondents' answers led to new questions. The method user attempted to avoid asking leading questions or questions that would yield only a "yes" or "no" answer. The method user had prepared a few questions and themes to center the interview around in case the respondent became quiet or waited for new questions. The method user used a subtle approach to keep the topics of the questions and answers within the relevant boundaries of the study, by using the previously prepared questions to steer stray conversation back to the topics of interest.

Focus on The "How" Phase in Iteration 1

During this phase, the focus of the questions were on the "how", that is, *how* the CPR supports the PT's work and daily activities. Examples of a few of the translated questions fielded were:

- How does the CPR help you to find information about a patient?

6 Establishing the Evaluation Framework

- How do you make a new patient entry into the patient’s journal?
- How does the CPR offer you to obtain an overview of prior events, treatments the patient was involved in, and ongoing patient contact with other care providers?
- How does the CPR assist you with decision making concerning the events and implications surrounding the patient’s diagnosis and treatment plan?

The idea was to establish what capabilities the CPR had to support the PTs and how these functions and features were used. Most of the interviews started out with “how” questions, thus setting a foundation for future sessions where the respondents could explain “why”. Since the “How” Phase focused on the “how” aspect, the indicators and concepts from this phase were derived from answers to “how” questions. These concepts were grouped so as to more easily create follow-up “why” questions posed in the “Why” Phase. After the interviews were banded and transcribed, the contents were analyzed with the intent of finding similar indicators, that is, excerpts from the interview transcription text made up of one or more sentences containing key words that give rise to a specific idea or concept. Similar indicators were identified and one or more could build a concept. These indicators were then grouped to form concepts. In some cases one indicator could help to form more than one concept. Figure 6.2 shows how indicators were extracted from the interview text.

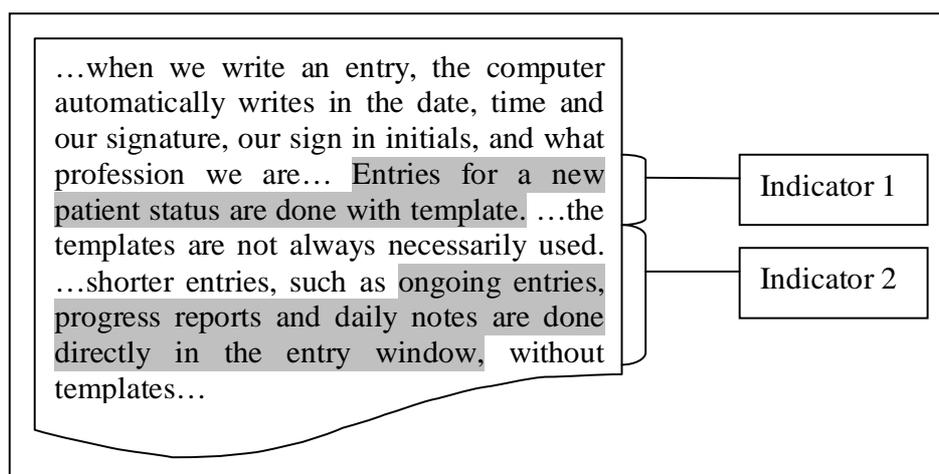


Figure 6.2. Two indicators, highlighted in gray, are identified from the interview text and in this case provided support for a concept.

Once the indicators were identified, they were grouped together with other indicators to provided support for concepts as shown in Figure 6.1. Some concepts were developed from indicators which also supported a previous concept, thus providing support for more than one concept. An example of this, is shown in Figure 6.3 where an indicator identified with one concept also lends support for an emerging concept which is further developed when other indicators are added for support. For a full list and description of all the concepts, see Appendix C.

6 Establishing the Evaluation Framework

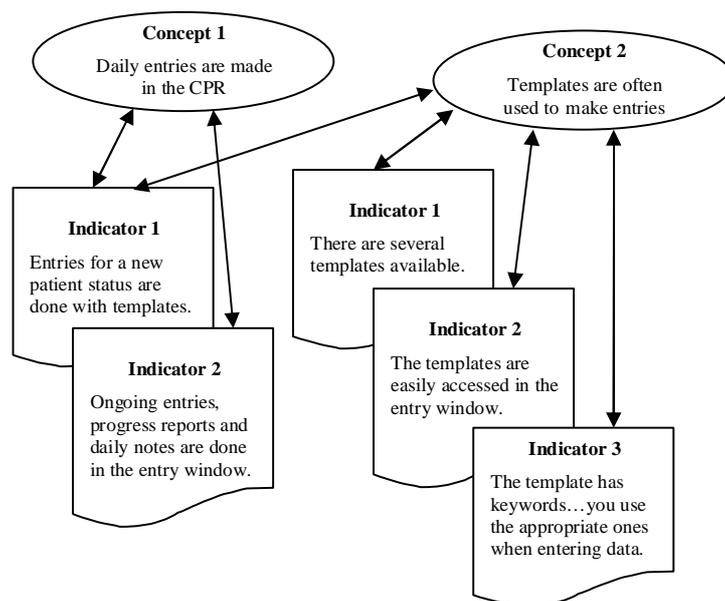


Figure 6.3. Example of how concepts emerge from the indicators. Indicator 1 in Concept 1 shows how indicators can be used in more than one concept. The indicators shown above are identified from the same interview text as in Figure 6.2, which deals with making entries and templates.

Focus on The “Why” Phase in Iteration 1

During the course of events, the themes for the questions became all the more focused on the “why” aspect. After transcribing an interview, themes for new questions were established when the method user discovered that a respondent hadn’t explained adequately enough why they did what they did. These themes were noted and posed as questions in the next interview session. Yet, at times it was often imperative to follow up “how” questions with asking “why” immediately so as not to lose the train of thought or natural flow of the conversation. A common pattern that resulted was that the respondent’s reply could result in a chain reaction of questions and answers describing events that unfolded as a result of explaining an initial question. In other words, during one interview session, there could be a rapid exchange between the two phases, thus maintaining a natural dialogue and establishing a means for obtaining an immediate understanding of a concept by posing a “why” question. For example, an excerpt of such a dialogue could be as follows:

Interviewer: “How do you make a new data entry into a patient’s journal?”

Respondent: “I use a template.”

Interviewer: “Why do you use the template?”

Respondent: “Because it makes writing a lot faster....the template has key words in the margins and I can choose which ones I need to use and then write my own text.....it makes the whole data entry process much easier.”

6 Establishing the Evaluation Framework

Interviewer: “How does it make it easier?”

Respondent: “The template has a structure and organization that makes entering information.... like filling in a standardized form. This is useful when writing a patient status report since there is a good amount of text that must be entered.”

As can be seen in the example above, a lot of information is yielded in an answer from a “why” question and it can easily lead on to new “how” questions. Once the interviewer transcribed the interviews and analyzed the contents, several instances appeared where a deeper understanding was needed of why an action was done. These were then noted and prepared as a questions for the next interview session.

Since the two phases for the First Iteration were intertwined, a resulting framework with influences from both phases started to take shape early on. The concepts created in the “How” Phase spawned concepts for the “Why” Phase. At the end of Iteration 1, and a total of three interviews, once with each respondent, the amount of data collected was deemed ample enough to develop a preliminary frame work. Figure 6.4 shows how the concept “Templates are often used to make entries” from the “How” Phase (see Figure 6.3) gave rise to Concept 2 in the “Why” Phase, where it is explained *why* the templates are used.

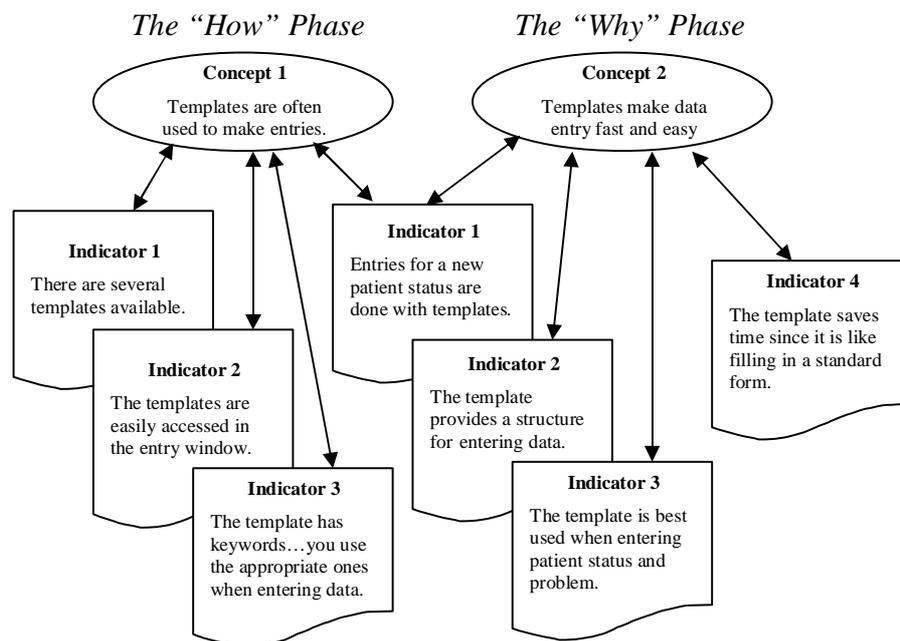


Figure 6.4. Here, a concept from the “Why” Phase derived from the “How” Phase is shown. In this example, the concept was spawned from *how* the data entries were done using templates and progressed to *why* the templates were used.

6 Establishing the Evaluation Framework

After the interviews for Iteration 1 were completed, all data was coded and analyzed with the aim of producing categories formed from the concepts (see Appendix C). Once the categories started to take shape, it was easier to see that some of the categories were too broad and vague, being comprised of a large number of concepts with varying aspects. These categories were targeted for closer scrutiny and thus became the objects of focus for Iteration 2.

6.1.2 Refining the Framework – Iteration 2

For this iteration, once again interviews were used in the same manner as previously for collecting data. The second iteration was carried out over 10 days, including the final coding and analysis. All three respondents were interviewed again for a total of four interviews, where one respondent was interviewed twice since the time allotted for the interview wasn't sufficient. In the case of this double interview session, it should be noted that the second interview was given two days after the first and no other respondents were interviewed during that time. The procedure for all the interviews were for the most part identical to the procedure in Iteration 1 and were conducted in the same alternating fashion between the two phases. After the coding and analysis from Iteration 1, the questions became more specific and focused on areas that needed more explanation, such as how searching for patients, information and filed documents in the CPR were done and why they were done in that manner. Aside from the interviews, the method user opted to implement observations of the respondents in action. These were mostly implemented during the "How" Phase of Iteration 2 and will be described in more detail in the following section. One other difference in Iteration 2 was that a fourth respondent was chosen, in the same random manner as the initial respondents were selected. The fourth respondent was to be included in the observational part of the iteration. The reason for selecting an additional respondent was strictly due to practical scheduling matters since one of the original respondents was not available for observing during the time the method user was present.

Focus on The "How" Phase in Iteration 2

During Iteration 2, observations were used as an additional source for collecting data and complemented the interviews. Observations, like interviews are a part of the data collection process in the 2G method. During the observations, the method user took notes and watched as the respondents showed how they used the CPR by "thinking out loud" as they went through the steps to complete an activity. Times for the observations were booked in advance when the respondents set aside time specifically for documentation and would not be interrupted with other clinical duties. Not all observations were void of dialogue between the method user and respondent. If the method user did not understand an action or statement during the observation, questions were posed and the respondent's answers and explanations were noted. The data collected from the observations helped explain how activities were accomplished from Iteration 1 but also assisted in creating potential questions for forthcoming interview sessions focusing on both "how" and "why" questions.

Most questions posed in this phase were based on previous questions that were already asked in Iteration 1, the difference being that there was a more specific focus on an aspect

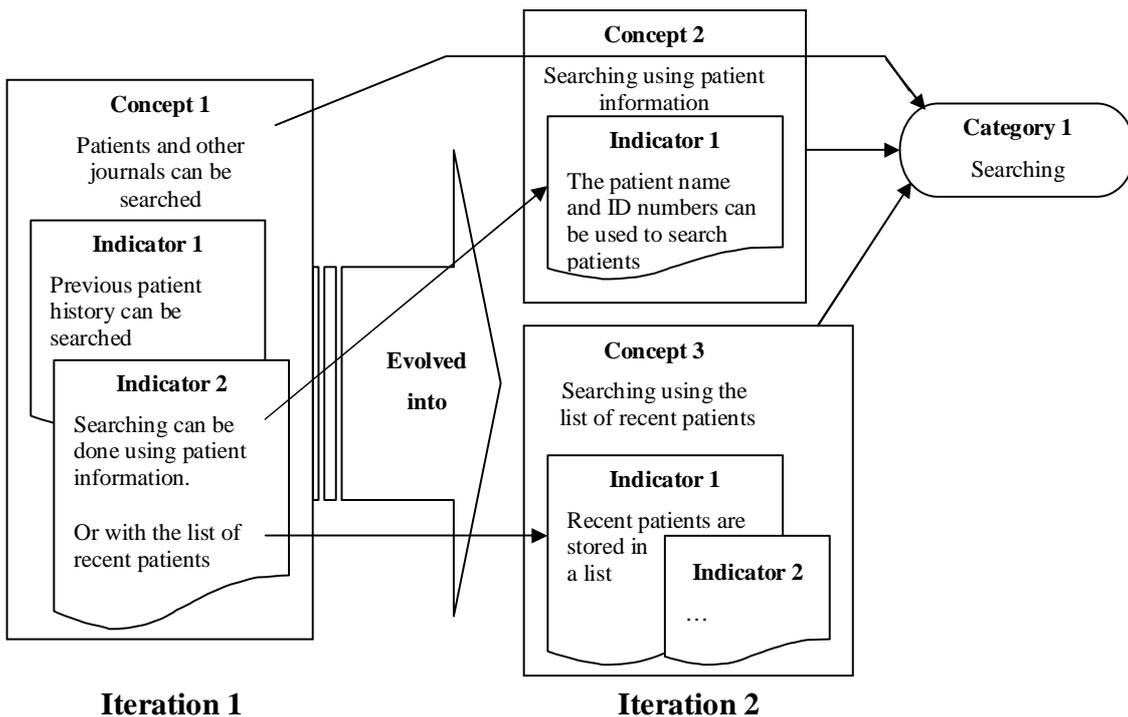
that was too vague in the previous answer. The idea was to get a more detailed description of exactly how an action was carried out in detail so as to accurately assess how the CPR supported a clinical activity.

Focus on the “Why” Phase in Iteration 2

Considerably more time was spent on the “Why” Phase than on the “How” Phase, since most of the groundwork of how activities were done had been laid in Iteration 1. Therefore, most of the interview sessions in Iteration 2 were focused on getting a better understanding of why a respondent did an action.

As was done in Iteration 1, the method user sent the transcripts of the respondents’ pervious interview only this time they were asked to reflect over why they did what they did, since that would be the focus of the next interview session, They were also encouraged to elaborate on any answers to questions they might have deemed too vague or in need of further explanation.

New concepts were created in Iteration 2 using the coded data from Iteration 1 as well as new data collected and coded from Iteration 2. An example of this with the concepts concerning Searching are shown in Figure 6.5.



Legend: → = Association between indicators and concepts

Figure 6.5. Evolution of a previous concept in Iteration 1 into newer concepts in Iteration 2. The newer concepts are built both from previous data collection in Iteration 1 and from further data collection and analysis from Iteration 2.

6 Establishing the Evaluation Framework

This refinement process, focusing mostly on the “why” aspect, led to the resulting framework of the evaluation where the concepts were grouped into categories. As the framework evolved, the method user was able to clearly see how the CPR supported certain activities the PTs engaged in, such as patient status documentation, gathering information about the patient and decision making. Furthermore, the reasoning behind why these actions were done in the manner they were, was made more understandable during Iteration 2. All new data was again coded and analyzed and categories from Iteration 1 were refined as well as new categories and concepts added to the framework.

The final step in Iteration 2 was to sort and link the concepts and categories in a hierarchical manner where subcategories were made when necessary. This was accomplished by listing tables of indicators linked to concepts which in turn were linked to categories. The linking and sorting was done in a spreadsheet by cutting and pasting text in the tables, thus forming a resulting framework where it clearly could be seen how indicators gave rise to concepts which in turn were the basis for forming categories. The final framework consisted of a four-level hierarchy. The top two levels were categories and subcategories, followed by concepts and indicators at the lowest level.

6.2 Post facto user assessment

In order to address the second objective of this study, an assessment of user perceptions regarding improvements for the CPR was carried out. This part of the study was not part of the 2G method and was initiated after the evaluation framework was completed. The purpose of the post facto assessment was enable the users to express how any shortcomings in the CPR could be addressed in future versions. Even though aspect was not focused on in the evaluation framework, it was still considered important and seen as a compliment to the evaluation. Questions for the post facto assessment were posed to respondents who had not partaken in the previous interviews since there was a risk that the original respondents could be influenced by bias from their participation in the previous evaluation process. Thus, the three remaining PTs at the clinic were chosen as respondents and would each partake in one interview session. Half an hour was set aside for the interviews with each respondent. A few days prior to the interview, the respondents were asked to prepare for the interviews by thinking about what improvements they would like to have implemented in the current CPR. The structure of the questions asked were based upon replies the respondents gave to questions from the interviews in the two iterations of the evaluation where the respondents spontaneously made remarks concerning their opinions regarding improvements for the CPR. When this occurred, the method user made note of the themes of these opinions and wrote them down on a separate paper in order to be used specifically for this part of the study.

The interviews in this part of the study were much more structured and prepared beforehand, unlike the previous ones given. A total of six questions were compiled. The questions and there purposes are shown below.

- What improvements or changes to the graphical user interface of Profdoc would you recommend?

6 Establishing the Evaluation Framework

Purpose: to find out exactly what changes the user would like to see in the graphical user interface so as to make it more appealing and easier to use.

- Which specific functionalities or features would you like to be able to access that Profdoc does not currently support?

Purpose: to investigate if there is any feature or functionality that is missing or some other activity done that the CPR does not support, yet could be implemented into the CPR.

- How could Profdoc make your documentation tasks easier?

Purpose: to find out how documenting tasks could be made faster and easier.

- If you were to give user feedback to the designers of Profdoc, regarding issues of improving Profdoc, what would you consider the most important issue they ought to be aware of?

Purpose: to get an understanding of how the users would like to see the CPR designed from their viewpoint. It is of interest to see how they think the CPR could be made more useful and simplify and improve their documenting and clinical tasks.

The method user collected the replies by writing them down on paper rather than by cassette recorder since the replies were relatively short and concise. The answers were later sorted and listed categorically. The results of the post facto assessment, as well as the resulting framework of the evaluation, are presented in the next chapter.

6.3 Summarizing the method application

The data collection from both iterations resulted in about 40 pages of transcribed text and roughly 21 000 words. The bulk of the data came from the six interviews with the remaining data coming from the three observations. When developing the Evaluation Framework the First Iteration had a primary focus on collecting data from the “How” phase. As mentioned earlier, there was a continuing shift between the two phases but the primary focus was on questions establishing how the CPR was used, with questions investigating why the functionalities and features were used being more of a support for developing the framework. During the Second Iteration, the focus shifted more on a “why” theme, and in turn, how the CPR was used became the supporting role so as to better understand the meaning of why they users used the CPR in the manner they did.

The three Post facto Assessment interviews resulted with nine pages of transcribed interviews. The answers were complimented by the respondents actively showing how an improvement could be implemented or where it could be placed.

7 Results

In the previous chapters, the initiation of the study and application of the method in the settings were described, as well as how the evaluation framework was constructed. In this chapter, the focus will be on the outcomes that evolved from the final evaluation framework after the two iterations and the results of the post facto user assessment. The goal of this chapter is to examine the results, that is, the evaluation framework and the post facto user assessment, and to understand how they address the previously stated aims and objectives of this study.

7.1 The final Evaluation Framework

A recapitulation of the objective for this part of the study was to identify the different features and functionalities of the system that users utilize and analyze *how* they are used and *why* the users use them in the manner they do. This was realized by interviewing and observing the PTs in their clinical setting using the 2G method thus giving rise to a resulting evaluation framework at the conclusion of the two iterations. The final evaluation framework produced a total of 138 concepts and 12 categories (see Appendix C). With the concepts and categories it was possible to understand and interpret how the CPR supported the PTs and made it possible to establish a model that reflected their current practice revolving around the CPR and thus fulfill the aim, which was to determine how well a generic CPR supported their clinical activities.

The resulting evaluation framework is presented below (refer to Appendix C for a more complete and detailed account of the categories and concepts). It consists of the resulting categories that evolved from the CPR's features and functionalities, how and why they were used, and the significance they had in relevance to the PTs' clinical practice. For a complete presentation of all the features and functionalities derived from the evaluation framework, see Table B1 in Appendix B.

Searching

The CPR was used to search for patients in order to obtain personal information, such as name and address but also to access the patients medical record. Searching was accomplished by entering the patient name or ID number or by scrolling in a list showing the most recent patients accessed by the user. Once a patient was found all available medical information and other journals for the patient written by doctors, nurses and other therapists coupled to this patient could be then accessed from the patient's journal page. Once inside a patient journal, internal searches could be done for filed documents, treatments and entries made by date or by different care providers. The CPR was used for searching patients and information since it offered a fast and reliable way to retrieve and access patient and clinical information.

Entries

Entries were most often made after each treatment session or as progress accounting for the progression of the patient's reaction to treatments and their current status. For new patients, entries were made using templates where a report was entered consisting of the

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patients problem history and an evaluation of the patient's physical status. The templates assisted the PTs by having keywords and headings already in place so only text concerning the patient was needed to be typed in. This saved considerable time and reduced the amount of text needed to be entered. Other entries were done when patient treatment and contact were terminated and a final evaluation was done. Templates could also be used for these notes as well as for writing an referral reply to the referring physician. All entries could be signed and were automatically locked, i.e., made available for reading only, after 90 days if they weren't signed.

Patient documents

All relevant filed documents for the patient and templates to create new text documents are accessed via the patient record. These documents are viewed, retrieved and searched for in the same manner as patients are. Writing patient documents is done free-hand or with templates and are signed and locked as is the case with normal entries. The documents present a record of previous events and decisions made regarding the patient and were regarded as an important tool by the PTs for decision making and assessing the status of a patient.

Accessing journal information

All information for a patient is accessed through the Patient Information Page. From here the PT can select different features of the record to view or interact with, such as past entries, documents, other journals showing prior or ongoing contact with other professionals. Once inside the patient record, additional information regarding the patient's current treatments, progress as well as previous events can be accessed.

Information exploitation

The information already stored in the patient record or recently entered is invaluable for the PTs for grasping an overview of the patient's past medical and diagnosis history and treatment progression. Furthermore, the information is used as a way to remind the PTs what was most recently done and what the results were. In so doing, the information is used to aid decision-making and to provide a plan of care for the patient. The information can be accessed as a database to provide other care providers with information of ongoing care by the PTs. The personal information of all patients, such as name, telephone number and address is conveniently available and makes it easier to contact the patient.

Customization

The CPR offered several features enabling customization. Templates were one such feature and were the most implemented. There were ready made templates for text documents as well as for making entries such as the evaluation status. The templates could be modified or generated from scratch by the PTs themselves. Most PTs took advantage of this so as to further simplify and hasten the task of entering information. The templates offered a structural framework for entering relevant data. The start page for a patient's record has several windows each showing an abbreviated overview of the latest four actions or events entered, treatments provided or important medical data that should be observed by a care giver. These windows and information could be customized

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by the PT so that only the information they found relevant would be posted, so as to give them a more efficient and faster overview of the contents of the information in the patient record.

Problems

There were two types of problems that arose with the CPR: technical oriented or design oriented. The technical problems were often traced to the network and hardware/software of the PC terminals and operating systems, such as system crashes, slow connections and down time. The design problems were confined to the CPR user interface architecture and layout but not limited to the existing functions and features, but also to those that were lacking, such as not being able to integrate independent programs in the CPR or being able to store and access pictures, drawings and other non-text based data. These problems were seen as more problematic than the generalization of the CPR, that is, it being designed as a tool to be used by several different professional groups.

Clinical support

The CPR clearly possessed advantages as a tool for organizing and accessing patient data and information as well as aiding in decision making and contacting other care providers. Not only that, but it was seen as being a superior choice over paper-based documentation since it provided better access, retrieval documenting and security capabilities and saved time and space. It enabled the PTs to provide more efficient care for their patients as well as keeping the PTs abreast of current happenings with the patients' diagnosis progression. The CPR as part of a network for the primary care region further offered a better way to access other professional journals, such as physicians', and to enable fast and reliable contact with other care providers handling the same patient as the PT. At the same time, it was noted that there is a risk that a patient's previous diagnosis history and/or evaluations by other care givers can give a PT a biased opinion of the patient's current problem if all information was accessed prior to the PT meeting the patient. Nevertheless, the PTs still regarded the CPR as a valuable tool for aiding the PTs in making clinical decisions regarding the patients' current diagnosis, status, treatment plan, and planning for future actions.

Program support

Most of the PTs using the CPR were introduced to it by taking an introductory class that started with basic computer usage skills and familiarity with Windows based programs. Those that did not take the class were given a quick introduction by colleagues yet they learned most on their own by trial and error. The relative simplicity of the system enabled them to learn the basic functions, such as patient information searching, retrieval, and documentation rather quickly and feel comfortable with it in a matter of days. The makers of the CPR, Profdoc AB provide new material and tutorials for each new version of the system. Each clinic has a staff member who has taken a special class where the focus is on trouble shooting common problems and how to configure the system to best accommodate the users and their setting. Any problems or questions that could not be solved on site were deferred to the technical personnel in charge of the system

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administration who would make the appropriate contacts and see that the problems would be attended to.

Supporting programs and accessibility

Several programs and access to functions in the network were available to the PTs, but were not directly a part of the CPR. However, the CPR is seen to be responsible to making these available to the PTs since the computerization of the medical records and connection to a LAN and the Internet make them made it possible to access and install such programs. Since these programs were used daily by the PTs in parallel with the CPR, and directly influenced the way they work in the clinical setting it was interesting to note how they were used.

Among the most common programs and functions were messaging (email and internal messaging to other care providers that were accessed in the LAN), the Internet by accessing online PT information and databases but also to put in orders for ambulatory aids such as walkers and wheelchairs, etc from the regional Rehabilitation Aids Center, and the capability of accessing independent programs such as Mobilus³, a program used to print out training programs for patients with pictures showing how they should do home exercise programs, etc.

User Interface

The CPR is designed to be used in a Windows milieu and is based on Windows applications, thus making it fairly simple to use and navigate around in if users are familiar with Windows programs. All functions are accessed by clicking on clearly marked buttons or double clicking in text fields in order to access a window with more detailed information (see Figures A2-A5 in Appendix A). All entries or filed documents are listed in scrolling lists which can then be clicked on to access them individually for viewing. The CPR has fully integrated word processing capabilities making it relatively simple to copy, extract and paste in text, thus saving time when making entries with the same information in different text documents.

Inconveniences

Aside from the technical and design problems, some inconveniences regarding the CPR were mentioned, albeit of a general nature, that is, they could be related to most CPRs, not just Profdoc specifically. Those users that were acquainted with paper-based journals felt that the CPR didn't save time in the long run since they still had to make notes on paper when evaluating patients and then enter them in the CPR. Most of the users also felt they write faster with a pen than typing, also a factor making entries slower than on paper. Another aspect was that the CPR is less portable than paper journals, often rendering some functions, like the booking and scheduling useless since the PTs needed these items with them throughout the clinical setting, thus making them choose the paper versions for booking and scheduling patients.

³ For more information access <http://www.mobilus.se>

7.2 Post facto user perceptions

In the following section, a brief description of the results from the four post facto interview questions, presented in chapter 6.3, is given. The results are a general summary of the answers collected. For a more detailed description of the interview answers see Appendix D.

What improvements or changes to the graphical user interface of Profdoc would you recommend?

- All buttons should be available on all the pages once inside a patient's journal. Some pages are missing them and one has to search for the commands in the menu bar.
- New "child" windows should be opened when accessing a new function from a parent window, instead of just opening a new page. This would save the users from having to click their way forward and backward through many pages when navigating.
- The layout could have another "quick access" menu bar to simplify accessing all the features in a patient's medical record.
- Being able to customize the journal and window interfaces would be good so that only the most commonly accessed features would be available for quick access and thus avoid unnecessary clutter in the limited window space.

Which specific functionalities or features would you like to be able to access that Profdoc does not currently support?

- It would be very good if there was a capability to store non-text documents in the journal, such as drawings, photos and scanned documents.
- Integration of drawing programs or the training program used to design individual workout programs with little pictures.
- Being able to access the Central Ambulatory Aids database so the user can make direct orders through the network instead of via the Internet. This way the orders could be directly saved electronically in the journal, not on paper as now is the case.
- Integration of independent programs such as electronic medical databases.
- Being able to sort the recent patient list by name, date or ID number.
- Each patient record should be available in separate windows so you can flip between them and not have to close a current patient in order to open a new one. The same goes for pages inside a patient record, one should be able to flip between filed documents or pages by opening new windows if so desired.
- Alerts when new filed documents have been added to a patient's record.

How could Profdoc make your documentation tasks easier?

- Eliminate the need to enter signatures, that is, confirm that the entry is correct and done by the correct care giver. A user is already logged on to the CPR so all entries are bound to that user. Having the user explicitly sign the entry by confirming they are the ones who are logged on becomes a redundant double task.

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- Integrate a complete word processor functions to make entering text more efficient and allow for inserting pictures directly into the text entry fields.
- Make multiple selections of patients in the recent patient list or select more than one entry to view in a record.
- Offer as much customization of the layout and available features as possible.

If you were to give user feedback to the designers of Profdoc, regarding issues of improving Profdoc, what would you consider the most important issue they ought to be aware of?

- A better user interface layout that makes navigation easier.
- Reduce the number of pages in a patient record and enable access to information via new windows.
- Access to information or utilities available in other software programs directly through the CPR.
- Make an overview of all information presented in a fashion that makes it easier to view relevant information quickly.
- An online tutorial explaining how to utilize all features and functions.

8 Analysis

The aim and objectives of this dissertation (see section 3.1) focused on how viable a generic CPR is for supporting specialist clinicians in their clinical activities and to investigate how the users deemed the CPR could be improved. To meet the first objective, an evaluation framework was developed and defined and for the second objective a post facto assessment was done to identify what improvements the users felt could make the CPR a more efficient tool for supporting their activities. In the following sections, the results of the study will be analyzed and interpreted in accordance with the two objectives and compared with the results of previous research done in this area. Furthermore, after the evaluation framework is analyzed, the method user will reflect upon some aspects of the 2G method application.

8.1 Evaluation Framework

The results of the study showed that the Profdoc CPR was able to meet the demands of the PTs in order to support their clinical and documentation activities. The PTs could effectively use the CPR to search for patients and information concerning the patients' diagnoses and problems pertinent to the patients' current physical therapy needs. The CPR was shown to be very efficient for finding information that was used to help construct a more complete picture of a patient's previous and current medical history so as to better understand they nature of the problem. In turn, access to this information enabled the PTs to make prudent decisions regarding future treatment as well as continuation of present treatments. Accessing other journals written by physicians, nurses and occupational therapists was shown to be a valuable source of information in order to offer a complete understanding of the patient's history, but also as a way of coordinating treatment efforts and planning by the different care givers. These findings support the results by Ueckert *et al.* (2003) where use of a CPR was shown to often eliminate double or unnecessary documentation tasks, enable better comparisons with existing data from documented from previous examinations by the same care giver or others and also providing for a patient record that can easily and efficiently span across institutional boundaries within the same network.

The advantage of internal messaging between other care givers corroborates Anderson's (2000a, 2000b) studies where the result of CPRs implemented in the workplace lead to intensified communication between health care practitioners both within and between departments.

The CPR provided a chronological structure of all entries and clearly showed which care giver made the entry as well as time and date. The contents of all entries were structured with keywords and headings so as to make browsing the entries a quick and easy procedure. The CPR enabled the PTs to use the entries as an aid for assisting their memories and being able to keep up to date on the progress of the patient's treatment and status. Furthermore, the information found in the entries was efficiently organized and legible so as to help the PTs when they wrote final evaluation statuses and referral replies to the referring physicians. The results of this study revealed that the CPR reduced the risk of errors made due to illegible text and that communication among staff members

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was improved. This correlates to a study shown by Anderson (2000a) where the reduction of errors and communication efficiency was studied. Access to all filed documents written by all care givers or received externally and entered into the patient's medical record was viewed as being very helpful since all care givers could access this information and not be reliable on one source. This information was also useful in determining the diagnosis, cause of problem and course of action for treatments and planning of care.

The CPR did not come without problems, yet these were not of any major issue to the PTs since most were due to external factors, such policy decisions, inadequate hardware and software, or technical issues with the network. Problems surrounding the CPR were more of a design nature and focused to the user interface and cognitive load instead of on a lack of functionality and features or inability to complete documenting or clinical tasks. Similar findings by Kaihara (1998) also showed such interface design problems. Nevertheless, in this study, the main complaint was the inability to enter and store non-text data and information such as training programs, pictures mapping a patient's areas of pain, or descriptive drawing showing the exact location of physical anomalies.

Despite the fact that the CPR was generic in nature and used by several different professional groups and not tailored for one specific group, there were still features in the CPR that enabled the PTs to customize the CPR so as to better assist them in their documenting needs. The most useful customization aspect was being able to create templates to assist in entering information. A few inconveniences were shown surrounding the implementation of the CPR, such as not being able to entirely eliminate paperwork and at times making some tasks redundant since the same documentation was needed to be done once on paper and then again when entered into the CPR. In these cases some of the advantages of the CPR, such as time savings, were negated, which is in contrast with a study done by Pose, *et al.* (1996) who found that the users saved time documenting since their freehand paper notes were very abridged and the bulk of the text could be typed into the computer much faster than when it was all written on paper. Nevertheless, the overall view of all the respondents, including the two who had previously used paper-based records, was that the CPR was advantageous over traditional paper-based documentation due to the searching, access and structural organization of data and information being much faster and more efficient. This favorable view is in agreement with the Pose *et al.* (1996) report. Furthermore, the introduction of the CPR caused the users to become more efficient with their evaluation and documentation routines due to its organizational and structural qualities and requirements. These findings from this study are similar to those done by Bieseimer and Chima (1997).

Access to other programs and utilities surrounding the CPR, such as the internal primary care intranet, Internet, emailing and intranet messaging was seen as additional tools that supported the PTs and made many aspects of their clinical activities and duties much more efficient and easier to carry out. The ability to send and receive messages to other care givers was seen as one of the greatest benefits as being part of a network since it saved considerable time because the users did not need to make direct telephone contact

with another and risk being put on hold or waiting for the other user to reply, but also because the user didn't have to wait several days for a postal reply.

8.2 Reflections on the method application

The implementation of the 2G method in this study was applied in a post-usage scenario. It should be noted that the original concept of the 2G method was developed for pre-usage evaluations and for evaluating CASE-tools (Rehbinder, 2002; Zaxmy, 2003) as support for software development and other IT tools (Hedlund, 1999). This study is the first documented case of using the 2G method as a post-usage method in a health care setting. During all phases of the study, the method user received guidance and advice from a mentor and expert in application of the 2G method, namely one of the co-authors of the said method. The access to this resource was a deciding factor when the method user pondered the possible approach for developing an evaluation framework.

Since the setting and software being evaluated in this study had not been previously tested by the 2G method, the application of the method was unique from the usual ways it had been implemented (Rehbinder, 2002; Zaxmy, 2003). Some noticeable differences were the use of the two phases in the two iterations. Instead of the strategic phase (the "why" phase in this study) being applied first in the iteration, it was the pragmatic phase, (the "how" phase in this study) that was focused on firstly so as to more easily understand the nature of subsequent "why" questioning. Another difference from the original application of the method and the application in this study was that there existed a frequent alternating between the "how" and "why" phases, and that each iteration had more focus on one or the other phase, that is, in Iteration 1 the focus was on the "how" and in Iteration 2 on the "why". Furthermore, it should be noted that the "why" questions were asked with the intention of the user to reflect over why they did a certain task as they did, that is, encourage them to contemplate whether they were actually utilizing the full potential of the CPR for that particular task or as support for other clinical activities in general. Naturally, at times the method user asked a "why" question with the simple goal to just understand why an event or activity was done or needed to be done in such a manner. In such situations it was more a case of the method user not being familiar with certain routines or aspects of the CPR, which the PTs themselves took for granted.

All in all, it can be said that the interviews in Iteration 2 were deemed to be the most fruitful since the respondents had more of an understanding of what they purpose of the study was after they had time to reflect and look over the data that was collected from Iteration 1. This reflection lead to more productive data collection in Iteration 2 and the respondents themselves became more spontaneous and active in conveying items of interest to the method user that may not have come forward if they had been more passive.

Finally, it should be noted that the 2G method provided a capable and dependable guide for developing the framework and helped the method user keep the focus of the interviews and observations relative to the aims and objectives of the study, thus making the whole process organized, structured, and above all relatively problem free.

8.3 Post facto user perceptions

The most common aspect for improvement noted by the users was a better user interface design so as to minimize the number of actions needed to be taken to arrive at a desired page or section of the patient journal. This result is corroborated by Beuscart-Zephir *et al.* (1997) where it was concluded that a cognitive approach to design of a CPR is necessary in order to obtain a better understanding of the connections between the data management and how the users use the information. The users felt there were too many windows open and buttons to click through to get to a filed document or entry field. Also, the inability to have several windows open at one time made it more cumbersome to flip between patient documents and information fields as well as between patient records. In order to solve this, the users suggested a design that had more characteristics of typical Windows based application, such as with multiple windows, menu-bars and drag and drop features. The problem of an ill structured presentation and organization of the information in a CPR had been documented by Ho *et al.* (1999) where they also found that in such situations, the potential benefits of the available information are rendered almost useless if they cannot be easily accessed and deployed.

The next item of importance was the users desire to be able to integrate other software programs they use, into the CPR. That is, they would like to be able to create text or non-text documents, pictures, photos etc in these programs and then directly save them in the patient records as filed documents, or directly in the entry fields. The reasoning for this was that it is often easier to explain a problem, exercise program or description of pain in pictures, diagrams or photos instead of words. Such non-text documents give a more accurate description of the problem at hand.

Other adjustments the users would like to see in future versions of Profdoc, were the ability to customize certain aspects of features and the user interface, such as what alerts and reminders to receive, full word processor functionalities integrated in the CPR when entering text, ability to customize the layout of the pages where the user can choose what information fields to be directly viewed. The reasoning for these customization features was to make the CPR more efficient to use for each user based on their individual needs due to the different ways the users use the information in the CPR to assist them in executing their clinical and documentation activities.

Despite the previously mentioned factors concerning the lack of functionalities and the design of the interface, the results showed that a generic CPR is able to adequately support PTs in their clinical and documentation activities. However, since this study focused only on one specific group of clinicians in a primary health care setting, care should be taken when assuming these results would apply to other clinicians, even those in a similar setting. Nevertheless, since the CPR's generic character was capable of supporting the high specificity of the PTs practice in a sufficient manner and its advantages were clearly considered as outweighing the disadvantages, the results indicate that other primary care clinicians in a similar setting would also be able to effectively deploy a generic CPR in their specialist milieu.

9 Conclusions and Discussion

This chapter summarizes the evaluation and post facto user assessment and the implications of these results and the contributions made by this dissertation. Furthermore, a discourse of these aspects will be discussed in the Discussion. Concluding this chapter are suggestions for future research related to this study as well as the method user's reflections over the project as a whole and the outcomes of the study.

9.1 Conclusions

The aim of this study was to investigate how viable and effective a generic CPR, utilized by clinical specialists, supported the clinicians in their clinical and documentation activities. The study showed that the generic Profdoc CPR was found to be an asset for the users and was directly responsible for improving their clinical tasks and providing more efficient health care to their patients. It was shown, that despite the CPR's generic design, and intent to be implemented in several different clinical milieus, the CPR was still shown to be an invaluable clinical tool used by specialists, and its advantages clearly outweighed the disadvantages. Furthermore, the aim was to investigate what the users felt would be improvements to the design and functionalities of the evaluated CPR. It was shown in the post facto assessment that the desired improvements were mostly of a general nature, such as the design and user interaction aspects, instead of being traced to a specific task or need the users had that was only found in their profession. Other improvements the users mentioned were not directly related to the CPR itself, and instead were related to technological aspects of the IT system such as the operating system, network and computer hardware.

Thus, the conclusions drawn from this study, that a generic CPR is an effective tool for clinical specialists, despite some aspects of design and lack of some functionalities, it was still assessed as being a viable clinical tool. These outcomes can be of use to health care administrators and policy makers when deciding what type of CPR to implement in a health care setting. This is important to consider, since generic CPRs can offer a cost benefit over tailor-made CPRs since they are more deployable across different settings within a network (Hannan, 1999; Ammenwerth *et al.*, 2003). Despite the fact that the Profdoc CPR was not specifically targeted for a specialist user group, it was shown to also have non-financial benefits, include improved quality of care, reduced medical errors and better access to information in the same manner as tailor-made CPRs (Wang *et al.*, 2003). This can have an impact on organizational decisions concerning future deployment of CPRs made by purchasers, designers and users.

9.2 Discussion

The results of this study show that a generic CPR with the characteristics of Profdoc can be of clinical support to specialists in primary care. To the best of the method user's knowledge, no previous study has been done to evaluate the effectivity of generically designed CPRs used by specialist clinicians. Due to this fact, it should be taken into consideration that in some highly specialized situations, tailor-made CPRs might be a better option, despite possible increased costs for health care organizations and clinicians. Furthermore, since this study did not evaluate another user group or more than one

9 Conclusions and Discussion

generic CPR, caution should be made when attempting to generalize the effectivity of generic CPRs utilized in primary health care by specialist clinicians. Surprisingly little research has recently been done in the field of selecting CPRs (Holbrook *et al.*, 2003) despite the ever increasing amount of available CPRs on the market to choose from (Wang *et al.*, 2003). The selection of a CPR is an important decision-making process for health care organizations since the decisions will have long term consequences and is one that carries great financial responsibilities (Holbrook *et al.*, 2003). Therefore, the information provided by this study can offer organizations, specifically large organizations, the possibility of considering generic CPRs as alternatives to tailor-made CPRs for each clinic or department in the organizational network.

The users were unanimous in admitting that the CPR supported their tasks instead of generating additional tasks. Another benefit of having a generic CPR is that since it is used by several different user groups, it has a more general structure and is not in risk of being overly structured and standardized for the clinic in focus, in the hopes of making the clinical tasks more rational and cost effective (Berg, 1999).

One aspect of this study that was considered interesting was that the initial reaction to the CPR by most of the users was that it was not a very efficient tool and at times seemed cumbersome and actually increased the PT's workload. During the method application, the questions posed to the users made them reflect over the situation and the way they used the CPR and why they used it as they did. This reflection seemed to give the users a more favorable view of the CPR, since they realized that they used it to assist them in many more tasks than just documenting. That is, it was not only used as a documenting aid, as a type writer, but also enabled them to quickly research the patients' prior diagnosis and treatment history, plan for future care, support decision-making and to communicate with other professionals so as to coordinate treatment and planning. Those users that had used paper-based patient records before CPRs, realized that the CPR offered a much better structure, organization and quicker access to patient data and information than was possible with paper-based patient records.

A final point of interest to mention was that this study also proved to debunk a general myth by the users that the faults with the CPR were due to it being too general and not specifically tailored for the users' needs and purposes. Certain customization structures and features were incorporated into the CPR so as to lessen some generic aspects and allow the users to more effectively access the features and functionalities relevant for supporting their clinical tasks, and it was a matter of the users understanding the CPR's potential. That some users were not aware of certain useful functions and aspects of the CPR might have been a result of the training and education they received when first acquainting themselves with the CPR. How well a CPR is exploited and reaches its full potential is fully dependent on the training the users receive (Olausson and Åkesson, 2003)

Profdoc fulfilled the objectives of a CPR (Lehoux *et al.*, 1999; Beuscart-Zephir *et al.*, 2001) by providing reliable archiving and database functions as well as supporting the users clinical activities and documentation tasks as well as tools for supporting communication with other professionals and for clinical decision making. Nevertheless,

some shortcomings were shown to be prevalent. These were at first viewed by the users as directly resulting from the generic design of the system and a seemingly flagrant lack of the PTs needs and requirements by the designers, but upon closer reflection were seen to be faults that could just as easily been present in a tailor-made design or other applications. On the other hand, generic CPRs should still be designed with the users' needs and requirements in mind, and preferably, in consultation with the future users of the system. The optimal solution is to have all users represented in the requirement specifications so all important aspects of use by the different users can be accounted for.

The results of this evaluation lead the author to conclude that despite certain shortcomings that Profdoc had, its advantages far outweighed the disadvantages and it was definitely a better alternative than the traditional paper-based solution that it replaced. Whether or not this would hold true for other generically designed CPRs is yet to be seen, since the quality and functionality of generic CPRs and all CPRs in general varies immensely (Wang *et al.*, 2003). This study made no attempt to evaluate Profdoc in comparison to another generic CPR and therefore, the conclusions that could be drawn here cannot be generalized for all generic CPRs but can be of value for CPRs of a similar nature and quality. With further understanding of the clinicians' needs and requirements a generic CPRs' effectivity and efficiency could further enhance the benefits and financial returns and should possibly be considered as a viable alternative when selecting a CPR.

9.3 Future research

The aim of this study was to evaluate an existing generic CPR used by specialists. The conclusions showed, that in this particular case, the generic CPR was deemed as an asset for the users. Yet, during the course of the study certain aspects and questions arose that are worthy of closer scrutiny despite being outside of the scope of this study. These aspects as possible future research in this area are discussed here.

9.3.1 Triangulation evaluation of a generic CPR

Since this study was confined to only one specific professional group, it would be of interest to evaluate the same CPR used by two other differing professional groups and compare the results with those found in this study. It is not certain that other professional groups that differ in clinical practice from PTs, such as physicians and nurses, would find the CPR as viable as the PTs in this study did. A widening of this study would be of use for both the manufacturers of CPRs to get a complete understanding of how general a CPR can be and which aspects should be more specific or even tailor-made to effectively fit the needs of the users. Furthermore, if a triangulation study result is similar to the results found in this study and the same generic design of a CPR can be deployed in various settings, this can have substantial savings for the CPR manufacturer and health care organizations (van Ginneken, 2002; Wang *et al.*, 2003).

9.3.2 Pre-usage evaluation of a CPR using the 2G method

From a method point of view, it would be of interest to apply the 2G method to evaluate other existing software tools in the health care domain, since prior to this study the 2G method has not been implemented in or transferred to a health care setting. The 2G method was originally designed as a pre-usage method for evaluating CASE tools

(Lundell and Lings, 2003). Therefore, it would be of interest to see how well the method could be applied, as it was originally designed and intended for, when deployed in a pre-usage study in the field of health care.

9.4 Reflections

It should be noted that the method user and the respondents were novices in the application of the 2G method in this study. A considerable amount of time was spent by the method user getting acquainted with the Grounded Theory (Glaser and Strauss, 1967) so as to better understand qualitative approaches in general. Several papers regarding the 2G method (Rehbinder *et al.*, 2002; Lundell and Lings, 2003; Lundell and Lings, 2004) were scrutinized by the method user in order to gain the necessary knowledge needed to apply the method. Despite the fact that the method user was a novice, the initial interviews still gave valid data, even though the length of the initial interviews were considerably longer than the remaining ones yet yielded slightly less relevant data. Since the method user had access to a mentor who was an expert in the application of the 2G method, the method user was able to quickly gain a grasp of the intricacies of applying the method effectively. It did not take long before the respondents were comfortable with how the method was conducted and understood their roles in the method application. Once the respondents understood this, their answers became much more detailed and they reflected more over why they used the CPR as they did, resulting in the method user being able to garner relevant data more effectively and over shorter periods of time.

The 2G method turned out to be a valuable tool for conducting the evaluation and developing an evaluation framework, despite the steep learning curve. Once the method was mastered it enabled the method user to concentrate solely on the data interpretation and coding. Furthermore, the method was useful in keeping the focus of the interviews and data collection related to the problem. The method's flexibility made it possible to adequately adapt it for use in the health care setting. The method user took advantage of this flexibility and made some minor adaptations to the method (see Figure 6.1) so that it would fit the purpose of this study.

Since this was the first time the 2G method was transferred into the health care domain, it is open for discussion exactly what kind of adaptations, if any, are appropriate when applying the method in this kind of setting. For this study, it can be assumed that the method user's choice of adaptations probably stemmed from the pre-knowledge and experience in the field and upon acquaintance with the method as it was originally designed for. It should be noted that the adaptations were discussed with the method user's mentor who was also a co-author of the method, thus assuring that the original intentions and uniqueness of the method would not be lost.

The 2G method provided a valuable guideline and structure for the interviews, data collection and coding processes, yet one aspect that was difficult to attain was when to terminate the data collection and focus on coding and analyzing the data. Obviously, data collection is terminated when the categories emerged can sufficiently explain what has been observed and there are no more relevant questions left unanswered or when data collection results in no new information (Orlikowski, 1993). Nevertheless, since this was the first time the method user undertook a qualitative study of this nature, it was not so

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clear when this threshold was reached and that no more iterations were needed. Termination of the interviews was done when the respondents had exhausted their full knowledge of the CPRs functionalities and features and could not think of any more ways they used the CPR. At the same time, near the end of Iteration 2, the relevant data collected dwindled thus promoting the method user to draw a close to the data collection of Iteration 2 and concentrate on the coding and analysis so as to establish a final evaluation framework. In retrospect the point of termination seemed clear, but when in the process it was not always that obvious.

Another issue for debate is the choice of method used. Since this was the first time the 2G method was implemented in the field of health care, it can be considered that another qualitative approach applied in order to collect and interpret the data (Orlikowski, 1993; Maxwell, 1996; Starrin *et al.*, 1997; Starrin and Svensson, 1998; Seaman, 1999) might have yielded different results. It should also be brought to mind that the method user's previous background in physical therapy and use of CPRs, could have had unavoidable implications on the results. For example, the method user may have unconsciously reached premature conclusions concerning a respondents description or reply, the result being that the method user filled in the gaps with previously gained knowledge prior to the study. Nevertheless, the method user made a point of seeing the setting and CPR from the eyes of a novice in the domain, but the influence of the pre-knowledge cannot be discounted.

Yet, the fact that the method user had prior knowledge of the domain and CPRs, that had an advantage of making the respondents feel comfortable with the interviews and knowing that they didn't have to spend extra time explaining all details regarding the setting or clinical activities. This was seen as a considerate time advantage and less of a cognitive burden on the method user. Furthermore, this previous knowledge was advantageous when the respondents explained why they did an action in the manner they did. The reasoning was that the respondents often didn't have to answer such questions in terms for the method user to understand why, but rather for themselves, that is, for them to reflect over why they used the CPR as they did and if there were other possible reasons for their actions. Aside from the method's flexibility, the self reflection by the respondents was an inherent characteristic of the 2G method that was invaluable and permeated the whole method application process, especially during the second iteration when the evaluation framework was refined.

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Appendix A: Screen images from Profdoc

1 The Profdoc hierarchy

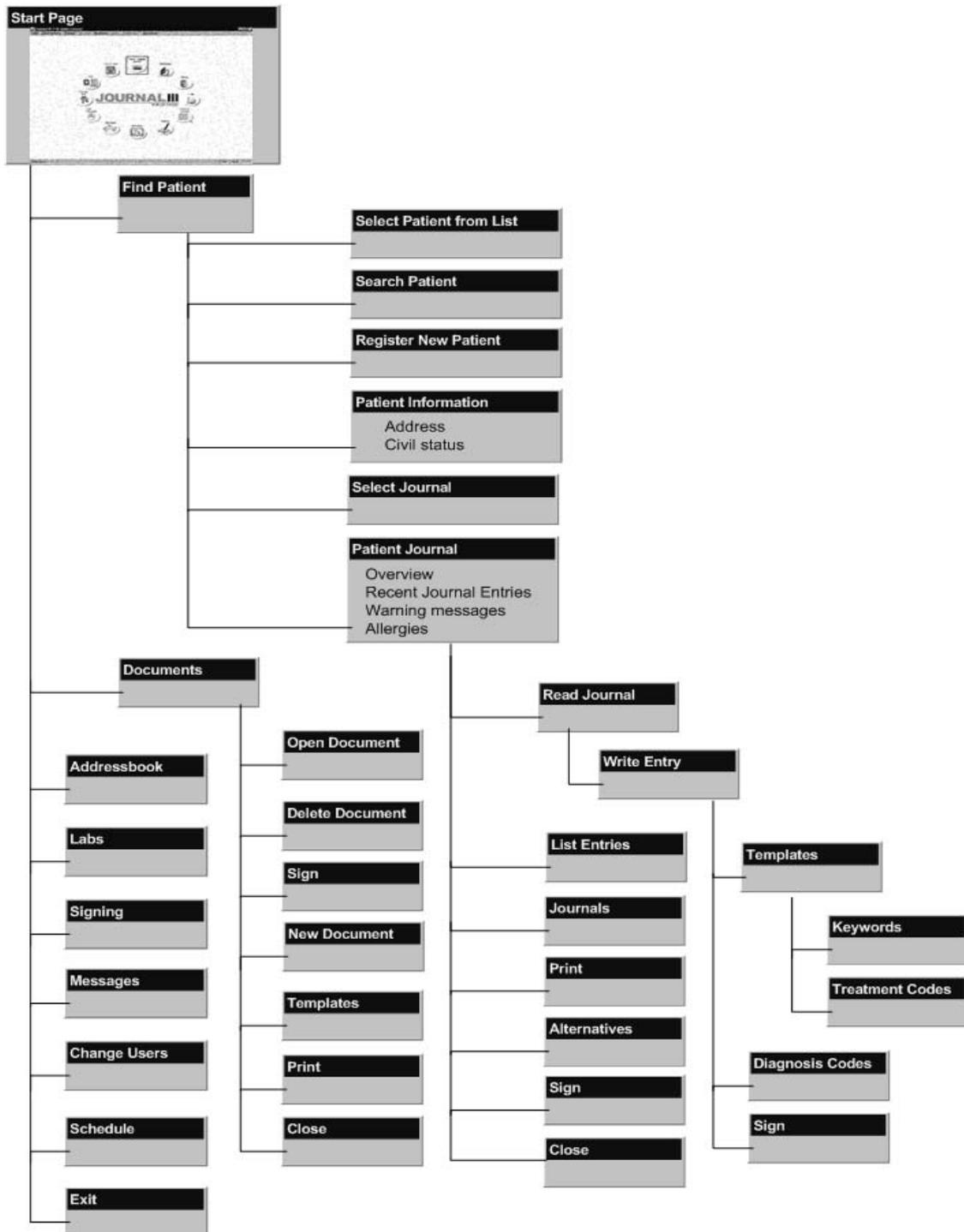


Figure A1. Hierarchy of Profdoc's functionalities, starting with the Start Page at the highest level with subsequent functionalities for each icon in the Start Page.

Appendix A: Screen images from Profdoc

2 View of the Start Page in Profdoc

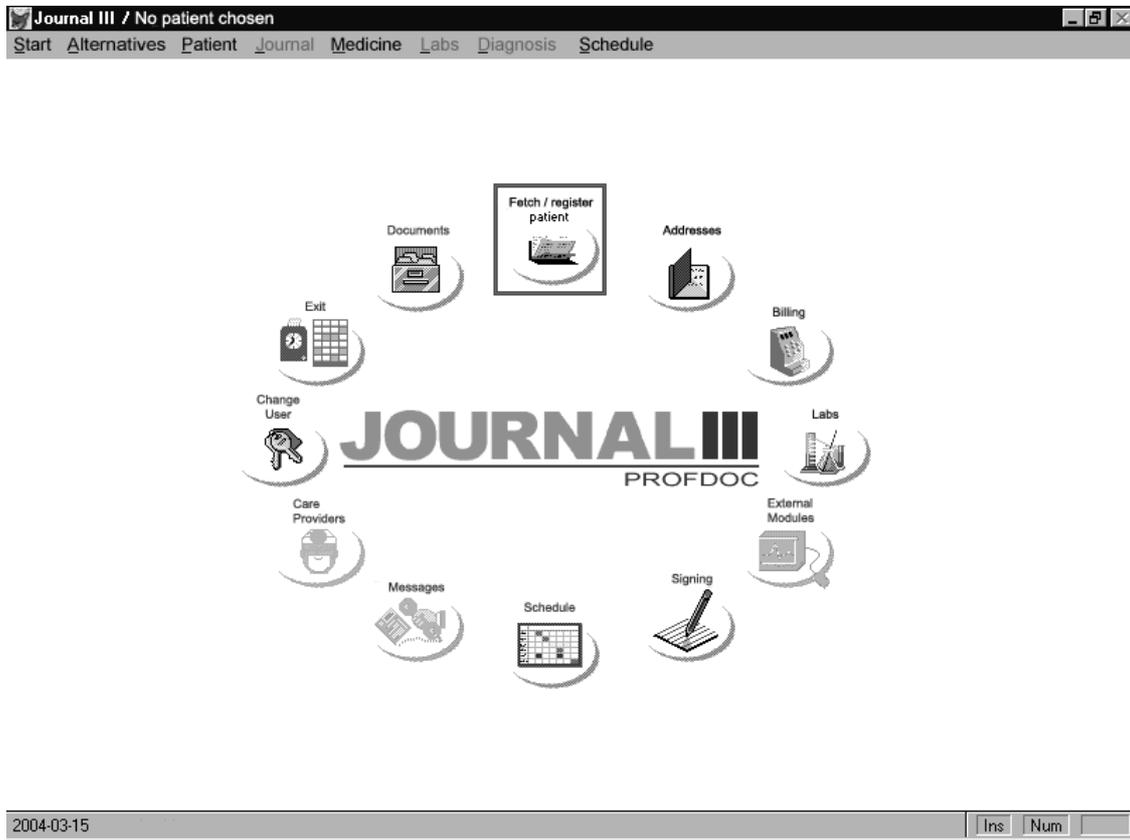


Figure A2. The Start Page or “Welcome Page”, as viewed when a user has logged into Profdoc. Each icon gives access to certain aspects of the CPR. In the above image, the framed icon “Fetch / Receive patient” is shown as active, and upon activation (mouse click) will enable access to a window where a patient search can be conducted (see Figure A4).

3 Patient Start Page in Profdoc

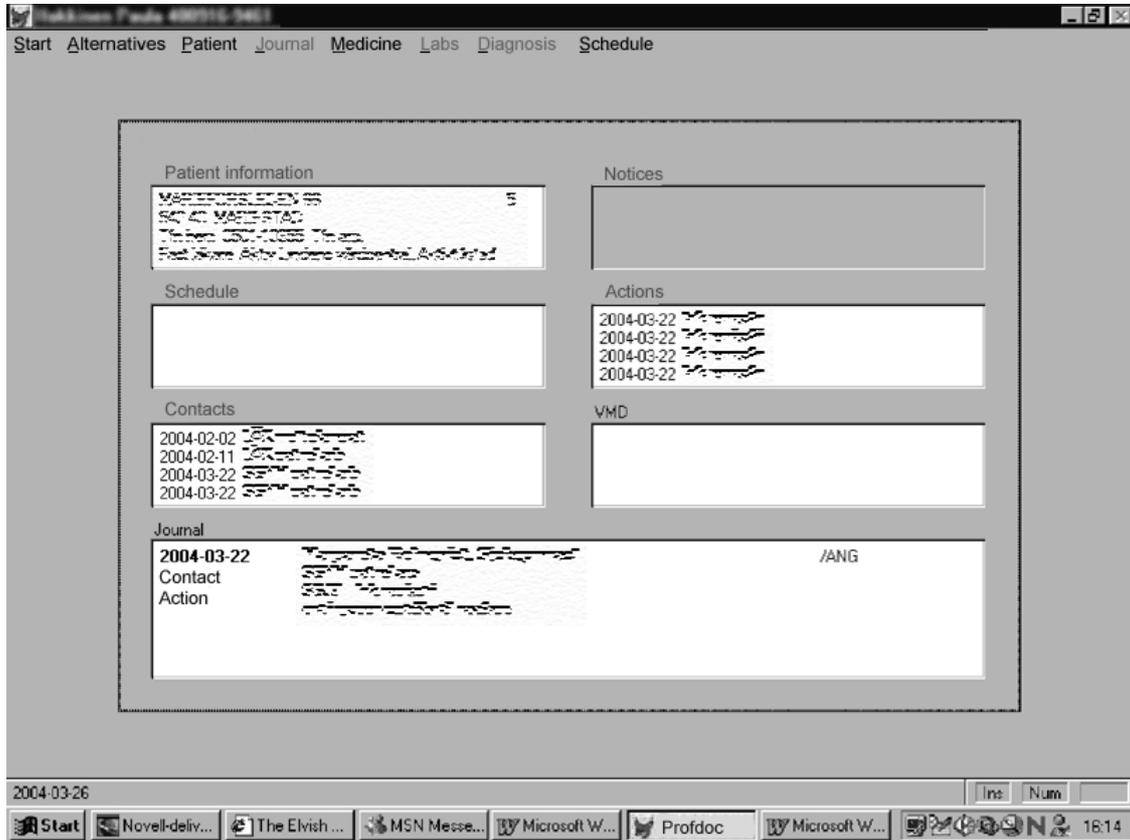


Figure A3. The start page for a patient's record. Each window above contains information ranging from the patient's personal data ("Patient Information" window) to the most recent contacts ("Contacts" window) and a quick overview of what was done during the last contact with a care giver ("Journal" window). Double clicking on each window takes the user directly to a new window and a list showing all the contents in that window.

4 Patient retrieval page

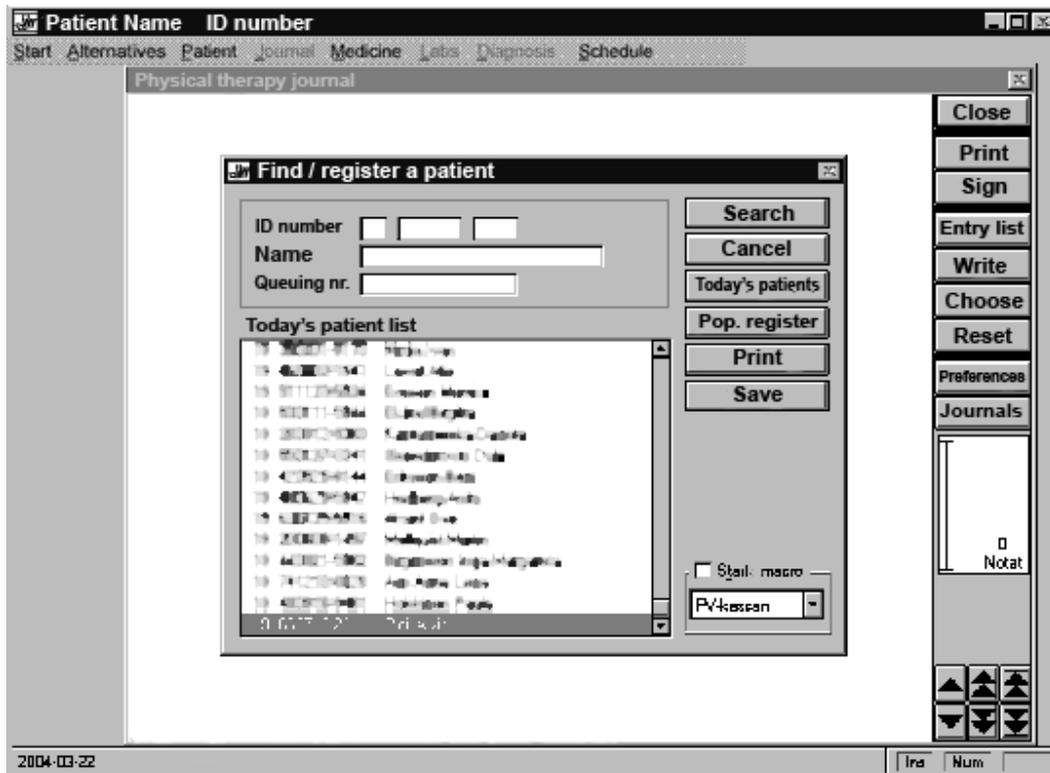


Figure A4. The above image is from the window where searching for a patient can easily be done by providing an ID number or the patient name. Entering a complete ID number gives a more exact result to the search, whereas only providing a name can yield a result with a list of several patients sharing the same name, unless the patient's name is unique.

Appendix A: Screen images from Profdoc

5 Entries and retrieval list

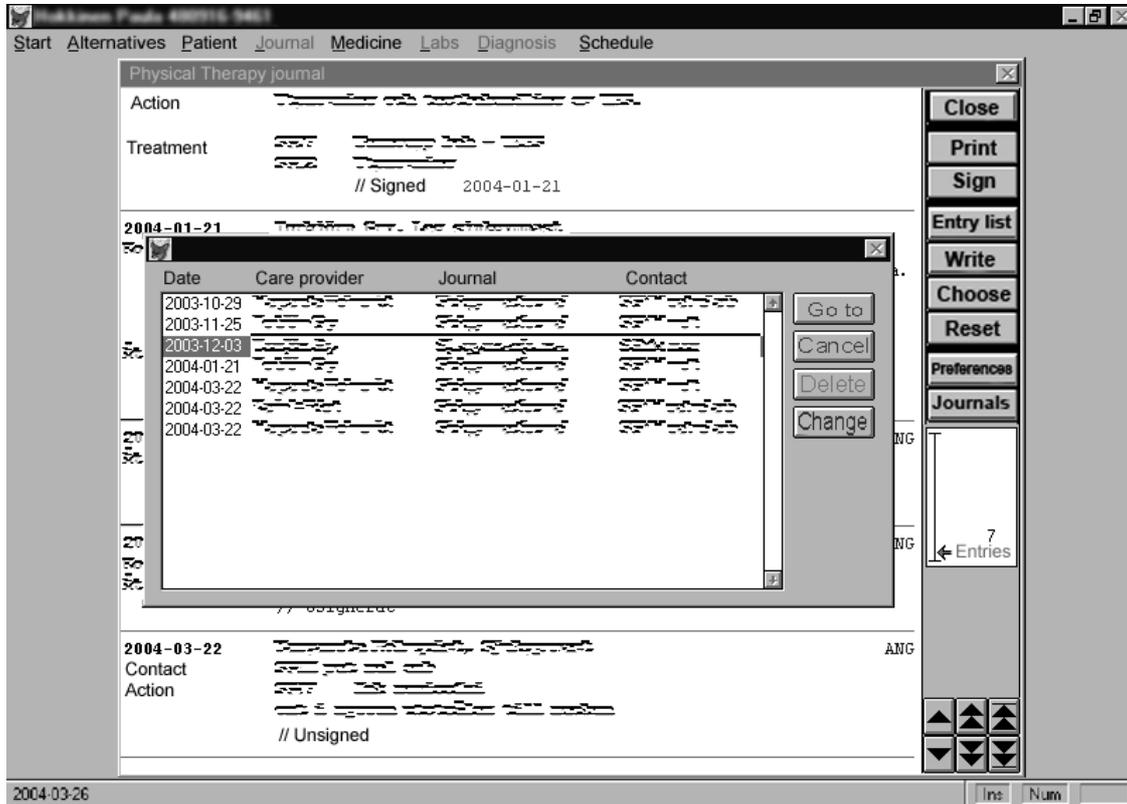


Figure 5A. Here the button “Entry list”, found in the right hand margin, was clicked and opened the smaller window listing all the entries done in this patient’s record from the PT journal. The advantage of this functionality is that a user can easily see an overview of the patient’s contact and entry history, which is valuable when writing a final evaluation or progress report.

Appendix B: Features and functionalities of Profdoc

Table B1. The text in each box is an explanation of the relation between the feature and functionality, or, if not applicable, N/A.

Functionality: Feature:	Searching	Accessing	Writing	Customization	Navigating	Planning	Decision making	Communication	Information exploitation
Patients	By name or ID number	From Start page	N/A	N/A	One at a time	N/A	N/A	Personal info with phone no.	Medical history contact info
Entries	By date or care giver	From patient record	Free hand, templates	Templates	One at a time in text field	N/A	By browsing history	N/A	Show past and present events and actions
Treatments	By code or date	In treatment list	Selecting code	N/A	Scroll in list or search	Browse progress notes	By browsing evaluations	N/A	Give history of types and results
Journals	By care giver profession	From patient record	Only applies for PT journal	N/A	Browse entries, documents	N/A	N/A	Can leave notes in PT journal	Sharing of care information by all providers
Templates	In template list	Selecting from list	Open "New template"	Fully customization available	Scrolling in list	N/A	N/A	N/A	Offer structure and organization
Problems	Automatic search only found on start page	Only one patient at a time open	Missing full word-processing support	Limited only to templates. No customization for GUI	Procedural access: one window at a time	N/A	N/A	N/A	No access to information when system is down
Documents	From patient record	From menu in patient record	Free hand or templates	"New empty document"	Select from list in patient record	N/A	Browsing information in documents	N/A	Results of tests etc available to all
Training	N/A	Online tutorials missing	N/A	N/A	N/A	N/A	N/A	Emails sent when new courses given	Enable full use of all features and functions
Software support	N/A	Help desk, onsite trained staff	N/A	N/A	N/A	N/A	N/A	Email or tel. with sys admin or Profdoc AB	Making training programs
Clinical Support	N/A	N/A	Good structure and organization	N/A	N/A	Treatment, diagnosis comparison	Treatments, termination, evaluations	Messaging with other care givers and institutions	Sharing clinical patient data and documents
Supporting tools	N/A	Via PC software	MS Office package	N/A	N/A	N/A	N/A	Email,	Internet, medical databases
User interface	N/A	From user profile	N/A	Patient start page text fields	Commands, buttons, menu	N/A	N/A	N/A	Quick and easy access

Appendix C: The Evaluation Framework

1 Searching

1.1 Searching patients

- Searching a patient is done by typing in their ID number in the window for registering patients. The ID number is best, since some patients have the same names. Searching patients in the CPR is much faster and easier than searching in paper journals.
- The patient's address and telephone number can be found very quickly by searching for the patient.
- All the patients I have registered are saved in a list that comes up when I log in. I can decide how many patient names I can keep in the list, and I can clear the list when I log out, if I want. But I usually leave at least the last weeks' patients there since I usually access them often, and then I don't need to search for them. That saves time also, but it gives me an idea of whom I have met recently.

1.2 Searching patient information

- Searching information in a patient record can be done manually (by scrolling through the chronological entries) or by searching the different categories: entries, treatments, filed documents or most recent entries.
- Searches for patient information are often done prior to meeting a new patient, but also during contact with the patient.

1.3 Searching treatments

- All treatments are coded so it is easy to search them and find them.

1.4 Searching entries

- All entries made by a care giver can be searched for in a patient's journal, manually or by entering search information. They can be searched by date, treatment or by care giver's signature or journal.

1.5 Searching other journals and filed documents

- I can use the same search procedures in the journals from the other clinicians. One can choose which journal to search, and then search by entry, date or care giver.
- Searching filed documents is done manually by scrolling in the document list.

1.6 Searching other care providers the patient has contacted

- Via the different journals where entries have been made we can search for a specific care provider by their signature.
- By listing all entries from the selected journals in the PT journal window one can search by date.
- Searching in the most recent contact list shows all contacts the patient has recently made.

2 Entries

2.1 Entries are made after all patient contacts

- All entries are in chronological order so it is easy to get an overview of them.
- All entries show the date for the entry and you can also put in the date for when the patient was there, so there are two dates, one for the entry and one for when the patient came for treatment. One can also make entries for conversations with the patient. All of this helps to give a better picture of the progression of the patient treatment.
- When we write an entry, the computer automatically writes in the date, time and our signature, our sign in initials, and what profession we are. The computer knows that information from when we log in. We all have our own user profile. That is good since it saves us time and effort so we don't have to write all that in each time.
- The CPR is good for keeping order of who I have met and which patients I need to make entries for.
- Ongoing entries, progress reports and daily notes are done free hand, without templates.
- Since it is easy to access other journals I can write a note referring to other journals or entries that contain previous information that is important by unnecessary to duplicate.

2.2 Entries can be made with templates

- Entries for a new patient status and previous patient history are best done with templates.

Appendix C: The Evaluation Framework

- A template is made up of key words I often use. I can choose which ones I want in the template, add and take away keywords. If I don't write anything on a line with a keyword, that line won't come up in the journal when I save the entry.
- Some templates are too general and I end up having to type in my own key words and other words anyway. Each patient is unique so I find some templates not specific enough. But I can customize my own templates but that takes time. Sometimes it is faster to write in text without a template.
- There are several templates we can access, along with our own that we can save. There are templates for us, occupational therapists, and other professions. They are all listed in the list under templates.

2.2.1 Templates make data entry fast and easy

- The templates save considerable time since they provide a structure for entering information.
- The template saves time since it is like filling in a standard form.
- The templates are easily accessed in the entry window.

2.3 Entering treatment information

- Entries for treatment types are made by finding the appropriate treatment from a list and clicking on the code, or writing in the code. Using the treatment codes save time since you don't have to write the same text each time.
- Treatment entries can be copied and pasted in an entry field for the present session if the copied treatment was the same as the current treatment . But the codes also take more time since you have to click your way to them. Sometimes it would be faster if you could just write the treatment without the code but we have to use the codes.
- I can choose the treatment from a list and just click on it instead of having to type it in.
- Another function that is good is that I can use quick commandos with the keyboard instead of using the mouse all the time.

2.4 Entering final evaluations and treatment termination notes

- Final evaluations and end of treatment termination notes are easily written since the CPR provides a good overview and makes it easy to see how many sessions the patient had, how they progressed and the start and end dates.

Appendix C: The Evaluation Framework

- A template can be used for the final evaluation, or one can write it in a text document template and then copy and paste it into the entry field if the document structure is desired to be used in the journal entry.

3 Patient documents

3.1 Accessing filed documents

- To view documents, I have to first be in the patient's journal.
- Filed documents are accessed via the menu bar and all available filed documents are listed in a list. By clicking on a document title the document is opened for viewing.
- The patient documents with the most use are physician referrals, referral replies from the PT to the referring physician, PT final evaluation reports, x-ray reports and lab tests.
- Documents are accessed and viewed often prior to meeting a patient for the first time, but also during contact with the patient since new information from other care providers can be added continually.

3.2 Creating documents

- Documents can be created by using special templates for each type of document. This is very good since it makes writing a document a standardized procedure and saves time compared to writing the document free hand.
- Documents can be created free hand also.
- All documents are digitally signed and locked once they are saved so changes can not be made. This is useful, since many documents are used as evidence of a patient's status by social agencies and other authorities.

3.3 Using documents

- Documents are valuable for the information they provide. The physician referrals describe the problem as diagnosed by the physician and aid us when we do our evaluations. X-ray reports are useful to get a better understanding of the problem. All document information can be used to assist us in making a correct diagnosis and delivering the best treatment.
- The documents provide a summary of previous events and results regarding the patient's diagnosis history.

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- The documents are useful since browsing them gives a quick overview of the patient's problem history without having to retrieve relevant information from the many pages of entries done after each patient visit.
- Easy access to the documents and quickly viewing them can also be risky, since it can make you biased when treating the patient if you rely too heavily on what others write. Sometimes one has to listen to the patient's story.

4 Accessing journal information

4.1 Non-PT journals

- I have access to physician journals, that is the doctors that work at this hospital and the other clinicians, such as the occupation therapists and nurses. But I use the doctor journals most.
- Only the journals that have something written in them for the patient are listed.
- The administrator decides which journals from another clinicians we can access.
- I can access these journals when I open the patient's journal and there is a list that asks which journals I want to see. I can choose just one or several.
- All selected journals show their respective entries in one window, all in chronological order, not depending on the journal.

4.2 PT journals

- All vital information concerning the patient's physical therapy rehabilitation and treatment can be found in the PT journal.
- Information available in the PT journal is both general (patient address, civil status, age, etc) and specific, such as physical therapy treatments given and actions done, available documents, summaries of treatment progress and evaluation statuses.
- Once a patient is chosen all available information in the journal is shown in the start page of the patient's journal. By clicking on a window one can access that specific information.
- All information can be viewed.
- In order to make an entry a new page will come up when the "write" button is clicked.

5 Information exploitation

5.1 Document information

- I use the information from the documents to find out what the patient has had for previous diagnoses, problems and what has been done and what tests and x-rays have been done.
- The advantage with accessing documents and the other journals is being able to get immediate answers and not having to wait for replies in the mail or on the telephone from the other clinicians.
- All documents help us since the information they provide can be useful if we need to make decisions regarding current and future treatment, when to terminate treatment and when drawing conclusions about a diagnosis.
- I also use the journal to see what I have written or if I forgot what treatment I gave the patient last time.
- I can use the information to help me get an idea of what treatments are working and what ones are not. I usually ask the patient what they think and document this in the daily notes so that I can see how the treatment is progressing.

5.2 Patient contact information

- Information entered after each contact with a patient is very useful since it provides us with a reminder of what we did in the last treatment session.
- When a patient arrives I just need to look in his journal and the latest entry I made and I see what treatment we did and what the results were. This is a useful reminder and I don't need to waste time asking the patient what we did last time.
- All post-treatment sessions, progress notes and other contact notes, such as telephone contact or conversations with the patient, are useful when writing an evaluation assessment or replying to a physician referral.
- All entries give a detailed listing of the patient's problem history and can be used as a reference for writing documents and assisting other care providers with information about the patient's status.

5.3 Journal information

- I look at other journals [physicians and other therapists] to help me build a better understanding of the patients problems and prior history.

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- But just as important is that I can see that I have understood the patient correctly, if I can compare what the patient has told me to what he has told others.
- I usually only use the information in the physician journals since the other professions [occupational therapists, nurses, etc] offer little information that is relevant for my knowledge of the patient.
- I can use the initial evaluations I made or other care givers did when assessing a patient's status, to compare with the final notes to see what progress or note has been made. This comparison is easy to do and view since the entries are all viewed in the same window in the journal.

6 Customization

6.1 Patient start page

- The start page can be customized to just show the information I find relevant for the patients. Not all the available information is necessary to view or access from this page. All information can be accessed once inside the journal.

6.2 Templates

- Templates for journal entries and documents can be customized and saved.

6.3 Recent patient list

- We can delete and add patients to the most recent patient list, or we can clear the list entirely. Having the list with the current patients we are treating is good since it enables us to quickly retrieve information about the patient without having to search for them by name or ID number, which can take time if one is unsure of them.

6.4 Limitations

- Customization is limited to lists, what journals to show and creating templates.
- It would be better if more features could be customized and if we could have more influence on what information we want to quickly access.

7 Problems

7.1 Technical and network problems

- The CPR program can crash at times, without warning.
- When a program crash occurs often some information is lost.

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- It seems like the computer gets slower and slower, so sometimes you have to wait if you click too fast.
- A technical problem is that the CPR system is updated now and then with new features that require more from the hardware, that is, our desktop computers.
- The computers we use are older computers that have not been updated for years and this is notable since we have noticed that it takes more time to load the program and certain actions take more time to complete and it can crash.
- Another problem is that the signing list takes a long time to load when you click to view the documents. It can take several minutes. I think this is a big problem since it makes me not sign from the list very often, I don't have the time to wait.
- Sometimes the network is down and we can't access the journals. At times even the IT department doesn't know why.
- If we don't log out of the system at the end of the day, the It department can't make complete backups and we are bombarded with messages regarding this. It would be better if users are automatically logged off when closing down the computer or if the computer is idle for more than an hour.

7.2 Design problems

7.2.1 Only text can be stored in journal

- The CPR cannot support drawings or saving pictures efficiently. All such information must be stored in separate paper files, individually with each PT.
- We can scan in pictures and documents, but the quality is not good and the scanned material is then saved in a document and not directly in the patient's record. Plus, it takes extra time to do the scanning since the scanner is coupled to a separate terminal and each PT must log in and out of this computer so as to make the scanned data available in the correct journal in the network.

7.2.2 Navigation and browsing

- When I need information for a patient and want to get it from a document or other journal, I have to close the patient journal and open the document, write down the info and then open the patient journal again and can then write in the information.
- Navigation in the program is not very well designed. Lots of redundancy. more often.

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- One can't easily flip between pages or places in the journal. You can only have one patient and one window open at a time, so if you want to go to see something else, like while you are writing, you have to close and save the page you are on and then back out and see what you want and then navigate forward to where you were. Sometimes it is easier to write down the information you want and then go forward and type it in. It seems that there is a lot of double work, redundancy, when navigating

7.2.3 Not all functions used

- Some functions are seldom used or hard to find, or we just aren't aware of them since they are "hidden" or hard to access.
- Functions we don't often use are easily forgotten, like how to customize a template.
- Other functions, like scheduling patients in paper calendars are easier to do by hand on paper.
- One can view statistics but we don't need that information for our work.
- I only use the most basic functions in the CPR, like searching patients, viewing and writing entries.
- I don't have time or interest to learn all of the available functions in the CPR. But I am sure there are good ones I don't know about and that could assist me if I was aware of them. The CPR should make all functions more visible.
- The waiting list function is not used. We have no waiting list. All new patients are deferred to a PT directly and then contacted for a visit.

8 Clinical support

8.1 The CPR can be used as a database

- If I want to get a quick summary of a patient I can read all the evaluation summaries, and referral replies. They are all listed. This makes it easier to read than going through all the entries.
- All actions and events concerning the patient can be searched and viewed.
- I use the CPR daily, even if I don't make any entries.
- I use it to read what treatments I gave and what the treatments I will give to the patients and make a decision if I need to make changes.

8.2 The CPR provides structure and order of all information

- Everything is organized and gives us reminders of what we have done. Like I can see what I did the last time for a patient and what treatments worked and didn't work.
- I can find all this information very quickly.
- The chronological ordering is very helpful to give us an idea of a patient's progress and treatment history.
- The CPR is more structured and organized than paper journals.
- It helps me to make faster decisions and gives me a better picture of what is happening with the patient and the treatment progression.

8.3 Messaging other care providers

- All new messages come up as soon as I log onto the network. Incoming message alerts are shown in a small window in the open journal so I can access them.
- Most contact with other care providers is done more and more electronically.
- I can contact other clinicians by sending electronic messages that they will see as soon as they log on to their computers.
- I can see when recipients have read my messages, and I can set the level of priority of the message also.
- All messages are saved until I choose to delete them.
- The messaging system is much better than phoning since the doctors are hard to get a hold of. The nurses are easier to reach so I usually phone them.

8.4 Security and privacy

- The CPR is that it is more secure than paper journals.
- Each user has his own login ID and password.
- There is no confusion of who wrote what. Only the logged in user can go in and make changes to notes they wrote (as long as they aren't signed, then no one can make changes).

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- If the CPR is idle for a few minutes the user has to log on again to access it, which makes the security better so unauthorized persons can't go in and read or make false entries.
- All entries must be signed with confirmation.
- When we save an entry we are asked if we want to sign it. If not it is saved but we can still go in and edit the entry.
- If we want to sign it, the entry is saved and we can never make any changes. There is a note that the entry was signed and saved.
- All entries that are not signed are listed in a list and from there I can sign them if I want. A problem with signing entries is that if you don't sign them within 90 days they will then be locked and you can't make changes or sign them.
- I usually wait a few days after I make entries before I sign them all. Or I wait until I am done with the patient, when the patient is no longer receiving care. Then I sign them. But sometimes I sign the entries directly if I know I won't make any changes.

8.5 Patient access to their record is available

- If a patient wants to see their record it is easy to print out the relevant pages.

9 Program support and education

9.1 Support

- Support and help when we have problems with the program is readily available.
- We have one of the staff who has gone an extra class to help trouble shoot so we don't have to call the help desk that much.
- Sometimes we have to call but they usually can fix it and if they can't it is often technical failures that are in part of the network.

9.2 Education

- An introductory course over 2 days was given to all of us when the system was installed. The course instructors were very good and even those users with no prior computer skills were able to use the CPR quite quickly and without major problems.

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- Those of us that didn't have a chance to take the introductory course were taught by fellow colleagues. The system was rather easy to learn once the basic functions were covered and it took about 3 days before one was independent and could use the system without relying on help.
- When updates are made we receive paper tutorials explaining how to use new features and functions. But it is up to us to take the time to read the tutorial and instructions.
- Continuing educational courses are lacking, but I am not sure if we would have the time to attend them either. It all depends on how much new material is needed to be learned.

10 Supporting programs and accessibility

The following programs and access to functions in the network are not directly a part of the CPR but the CPR is seen to be responsible to making these available since the computerization of the medical records and connection to a LAN and the Internet make them available. Since these programs are used daily by the PTs and directly influenced the way they work in the clinical setting it was interesting to note how they were used.

10.1 Regional intranet

- The county health care system has its own intranet with web pages only authorized users can access. Internal information is posted on these pages as well as employment opportunities, etc.
- The connection is secure and enables us to send messages to other members containing sensitive patient information and data.

10.2 Mobilus

- Access to the Mobilus program that allows us to make picture-based training programs is available, but not directly through the CPR, but as an installed software in the PC.

10.2 Internet

- We have unlimited access to the Internet and online medical databases.

10.3 Email

- All users that have a login ID have an email account in the health care system's domain name.

11 User interface

11.1 The CPR is based on Windows applications

- The program is Windows based and if one is familiar with these types of applications, one can easily navigate using the buttons which clearly explain each action behind them.
- Aside from some minor problems with the interface (see section 7 in Appendix B) the user interface is relatively simple to use and it is easy to use all the basic functions.
- Most relevant information or information on how to access non-visible information is readily available and easy to see.
- The layout makes it possible to easily navigate around in the journals.
- All pages are set up in a similar manner and the design is consistent so it is easy to browse in other journals since they are all similar in structure and style.

12 Inconveniences

12.1 Paperwork is not totally eliminated

- A problem with the paper reports or pictures we can't save in the journal is that it is problematic for others to access them. They have to go to the person who made them and ask to see them. It would be better if they were in the computer and everyone had easy access to them.
- We still have paper referrals and letters from doctors we must reply to in paper since we often have to write on the same paper, our reply.
- All paper referrals from doctors must be saved for at least a year (health care rules). These are saved in folders and binders, along with any paper notes we make.
- I take paper notes when I meet the patient privately in the treatment room and can't have the computer with me. But even if I did have the computer in the same room I would still take paper notes since I can focus more on the patient.
- Taking paper notes and then having to type the same information in the computer again seems redundant to me, so I am not sure the CPR saves time when making entries. Entries in paper-based journals are made faster.

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- I feel that I have to write more in the CPR than in the paper journals. The CPR requires more information to be entered, which is good since the record is more complete, but also it takes more time for me to type than to write by hand.

Appendix D: Post facto User Assessment

What improvements or changes to the graphical user interface of Profdoc would you recommend?

- There is a consistency problem with the layout. All buttons should be available on all the pages in the same manner once inside a patient's journal. This is not the case for all pages. Some pages are missing them and one has to search for the actions as commands in the menu bar. It would be best if all of the actions in the menu bar are available as buttons in the windows.
- New "child" windows should be opened when accessing a new function from a parent window, instead of just opening a new page. This would save the us the problem of having to click our way forward and backward through many pages when navigating. It would be good if the patient's journal start page would always be open so one can quickly access other windows from there and be able to flip between windows.
- The layout could have another "quick access" menu bar to simplify accessing all the features in a patient's medical record.
- Being able to customize the journal and window interfaces would be good so that only the most commonly accessed features would be available for quick access and thus avoid unnecessary clutter in the limited window space.
- The patient record start page should be more apt to customize, not only for adding and deleting certain information in the windows, but by being able to directly access journals or documents without having to search for them in the menu bar.
- Drag and drop features would be good, for example if you could drag a patient's name or ID number to the "patient record" icon it would automatically open that patients journal.
- The layout could be made more "Windows - like" than it is.

Which specific functionalities or features would you like to be able to access that Profdoc does not currently support?

- It would be very good if there was a capability to store non-text documents in the journal, such as drawings, photos and scanned documents. Non-text documents are often more descriptive than text and can save more space and are easier to browse through quickly.

Appendix D: Post facto user assessment

- Integration of drawing programs or the Mobilus training program used to design individual workout programs with little pictures. These can be stored in the journal and easily printed out for the patient but also give other PTs an idea of what kind of training had been done. At the moment, we don't describe training programs in detail since it takes too much time to do that with text.
- Being able to access the Central Ambulatory Aids database so the user can make direct orders through the network instead of via the Internet. This way the orders could be directly saved electronically in the journal, not on paper as now is the case.
- Integration of independent programs such as electronic medical databases, medical dictionaries.
- A spellchecker would be good, so as to eliminate confusion with misspelled words.
- Being able to sort the recent patient list by name, date or ID number. Being able to customize the recent patient list, for example, how many names to show or have them shown by day or week.
- Each patient record should be available in separate windows so you can flip between them and not have to close a current patient in order to open a new one. The same goes for pages inside a patient record, one should be able to flip between documents or pages by opening new windows if so desired.
- Being able to select more than one treatment code when entering them in an entry. Currently we can only select one at a time and have to backtrack to the treatment page and fetch new treatments. This is redundant.
- Alerts when new documents have been added to a patient's record.

How could Profdoc make your documentation tasks easier?

- Eliminate the need to enter signature confirmation. A user is already logged on to the CPR so all entries are bound to that user. Having the user make a signature confirmation becomes a double task.
- Integrate a complete word processor functions to make entering text more efficient and allow for inserting pictures directly into the text entry fields.
- Make multiple selections of patients in the recent patient list or select more than one entry to view in a record.
- Offer as much customization of the layout and available features as possible.

Appendix D: Post facto user assessment

- Messages from Profdoc notifying of new features.
- When making an entry with a different date from the current date, it would be easier if all pages have direct access to the “change date” window, instead of having to backtrack to that window before hand.

If you were to give user feedback to the designers of Profdoc, regarding issues of improving Profdoc, what would you consider the most important issue they ought to be aware of?

- A better user interface layout that makes navigation easier.
- Reduce the number of pages in a patient record and enable access to information via new windows.
- Access to information or utilities available in other software programs directly through the CPR.
- Make an overview of all information presented in a fashion that makes it easier to view relevant information quickly.
- An online tutorial explaining how to utilize all features and functions.