

# A Model of E-documentation of Community Nursing

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This article presents the development of electronic documentation for community nursing using a system approach. Documentation is viewed as an information model for organizing and managing processes. The community nurse plans the nursing process after gathering and evaluating information on the patient's health and his/her family status. Documentation is thus considered to be a basis for the successful work of the health team and as a way of ensuring quality in nursing. The article describes a prototype software model for e-documentation in community nursing together with its evaluation in practice.

**Key words:** nursing, community nursing, modelling, documentation, software solution

## Model e-dokumentacije zdravstvene nege v patronažnem varstvu

Prispevek predstavlja sistemski pristop k oblikovanju elektronske dokumentacije zdravstvene nege v patronažnem varstvu. Dokumentacija predstavlja informacijski model, ki je namenjen organiziranju in upravljanju procesov. Na osnovi informacij, zbranih z ocenjevanjem zdravstvenega stanja pacienta oz. stanja razmer v družini, medicinska sestra načrtuje proces zdravstvene nege. Dokumentacija je temelj za uspešno delo zdravstvenega tima pa tudi element zagotavljanja kakovosti zdravstvene nege. V prispevku bo opisan prototipni model informacijske rešitve za izvajanje e-dokumentacije v patronažnem varstvu.

**Ključne besede:** zdravstvena nega, patronažno varstvo, modeliranje, dokumentacija, programska rešitev

## 1 Introduction

A system approach in the organizational and informational context brings specific challenges in terms of the complete management of complex systems (Kaplan, 1997). Systems in healthcare, of which nursing is a part, similarly belong within this framework (Taylor, 2001; Van Bommel and Musen, 1997). Along with the system approach, it makes sense to use the potentials of contemporary information and communications technology (ICT) and to study the possibility of adding value in managing complex systems, especially in terms of the effective use of resources and quality assurance.

E-documentation of any process is an information model, which uses ICT for organizing and managing the process according to established goals. Nursing documentation consists of patient and family data. Nurses use these data to plan the nursing process, which in short covers assessing patient's nursing problems, making nursing diagnoses, implementing nursing interventions and evaluating the work (Gordon, 1994; Taylor et al., 2001). The documentation of the nursing process is the basis for the successful work of a nurse, and also represents an element of quality assurance in nursing (Ball et al., 2000; Rajkovič et al., 2000; Saba and McCormick, 2000; Potter and Griffin Perry, 2003).

Existing nursing documentation mainly consists of words, and only rarely includes graphs and pictures. It provides a data set that serves as a base for a software solution (Šušteršič et al., 2002; Klein, 2003). As long as such documentation is kept manually, ICT possibilities are not exploited. It makes sense to use object-oriented approach to the reengineering of documentation into electronic form (McFadden and Hoffer, 1994; Barry, 1996; Kroell & Birthe Garde, 2005), which enables more suitable structuring and processing of data in electronic form. It is thus a matter of structuring the documentation in terms of an object orientation, whereby classical data are combined with models and procedures for their implementation, e.g., graphic presentation of numerical data (Kaplan 1997). At the same time, when reengineering the documentation, possibilities and needs appear for the reengineering of basic processes (Jacobson et al., 1994; Ferioli, Migliarese, 1997; Chang, 1999; Meystel and Albus, 2002) in the organisational sense, in this case in the field of nursing.

We wish to propose a model that will serve for the reengineering of classical documentation into e-documentation. With a suitable object-oriented organisation and use of contemporary ICT it is thereby possible to achieve a higher level of quality especially in regard to integral treatment of the patient. The active computer model itself sup-

ports the work of the nurse and, at the same time, reduces the possibility of mistakes at work.

This article is based on findings and models developed within the framework of a *Project for preparation of a model tool for establishing quality with the aid of documentation in nursing* at the Ministry of Health of the Republic of Slovenia. Below are presented the elaboration and implementation of the proposed model, as well as testing of the prototype software for community nursing.

## 2 Analysis of existing documentation in nursing

Using the survey research we first analysed the current state of documentation in nursing in selected health organisations in Slovenia. The sample included three old people's homes, Ljubljana Health Centre with five units, Clinical Centre Ljubljana and Maribor General Hospital. We distributed 386 questionnaires, of which 286 (response rate of 74.1%) were returned.

From the results of the survey on the use and suitability of nursing documentation we can conclude both the actual state of the documentation itself and the process of documenting, and also the perception (opinions, considerations) of existing problems and possible solutions on the part of those surveyed.

The majority of documents (86%) are prescribed on the level of the institution. The only exceptions are community nursing and old people's homes. Documentation for community nursing is prescribed and unified throughout the country, while old people's homes have a uniform computer supported information system. Rather less than 13% of documents are computer supported. Among the types of documents, the following were most frequently listed: nursing care plan, referral/discharge document, continuation notes and variance report, admission document and report on an undesired event.

It can be concluded that those five most frequently used documents should be unified firstly, taking into account the specificities of individual services. Given that with contemporary ICT we can generally provide effective support to documentation and increase the use of computers.

From the perspective of content, a process method of work is only used in 32% of nursing documentation. Over 52% use only a fragmented process approach. It appears that existing documentation is to a large extent at fault for this, since the majority uses only those elements that the documentation enables. It is therefore sensible to reengineer the documentation in a way that will enable documenting all phases of the nursing process.

Minimal data set on patient are recorded by three quarters of survey participants. One of the reasons that the percentage is not higher is unsuitability of existing documentation.

Discussions with the patient, observation of the patient and measurements are sources of data for completing documentation in more than half of cases. Slightly less than half have also stated nursing documentation as a regularly used source of data. It is sensible to consider links between other health documentations and nursing documentation.

In the opinion of the surveyed nurses, they see the purpose of documentation or documenting mainly in the continuity of nursing, security for members of the nursing team and patient and an account of the work of individual members of the nursing team. The content thus supports the work, with emphasis on the legal security of members of the nursing team and the patient.

Among reasons for the non-use of nursing documentation, according to a quarter of nurses, are understaffing and insufficient knowledge of the nursing process, and among unspecified reasons, the fact that existing documentation is unsuitable was most often noted.

In terms of the influence of nursing documentation, the following are highlighted: the quality of nursing, uniform doctrine of work and reducing the possibilities of mistakes. With improved documentation we expect most changes in the quality of collaboration inside the health team and in the distribution of work and responsibilities among nurses and other health team members.

The results have shown that reengineering documentation using ICT can and should positively influence on the quality of nursing care. Because of unified documentation in the community nursing we have decided to begin the reengineering of documentation in community nursing.

## 3 Process method of work in nursing

The basis for developing e-documentation is the nursing process. Figure 1 shows a schematic presentation of the process method of work in the IDEF1 standard. The division in the figure differ from the literature (Taylor et al., 2001), and Table 1 shows the link between the two models. A major difference is in the stage of evaluation due to standardisation restriction. IDEF1 standard does not allow any process to appear in the scheme more than once. There is also a difference due to the cybernetic feedback loops, which are of crucial importance from a systemic point of view for system management, in this case of nursing.

The user interface of the prototype supports this process method in the nurse's job sequence. Only a few elements must be added, which are specific for community nursing (Rajkovič and Šušteršič, 2000). These are elements such as entering referrals for community care visits to patients or families and for planning dates of home visits. Home visits can only be planned on the basis of referrals received from the general practitioner and on the basis of instructions for implementing community nursing. Later on the same steps apply for each home visit as in the already mentioned process scheme.

## 4 Database model

The base for a software solution is a database that enables data archiving and accessing data. Critical analysis of nursing documentation was a starting point in the database design process (Handler and Hieb, 2003).

In paper form, the documentation is often mainly unstructured. Thus words in sentences can be entered. A problem occurs when seeking data in a longer text. The legibility of the writing often presents additional difficulty. Similarly, the statistical processing of data for research,

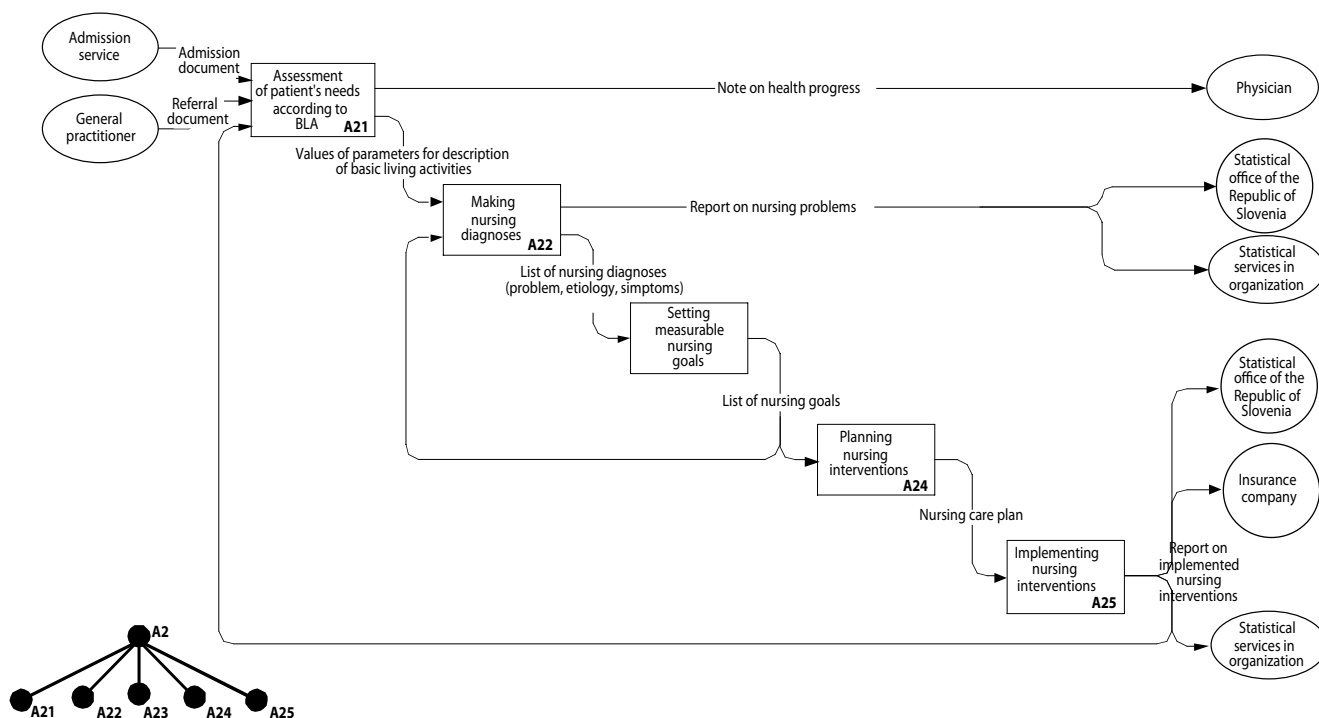


Figure 1: Schematic presentation of the process method of work in nursing according to the IDEF1 standard

Table 1: Comparison of phases of the nursing process and the schematic presentation in Figure 1

Stages of nursing process	Sub-processes of the process method of work in Figure 1
1. Assessment	A21 Assessment of patient's needs according to basic living activities
2. Diagnosis	A22 Making nursing diagnoses
3. Planning	A23 Setting measurable nursing goals
	A24 Planning nursing interventions
4. Implementation	A25 Implementing nursing interventions
5. Evaluation	A21 Assessment of patient's needs according to basic living activities
	A22 Final evaluation; making changes in the list of nursing diagnoses

education and other purposes can become unreasonably difficult (International Council of Nurses, 1999).

The higher level of data structuring in electronic form enables a higher usability of acquired data. The nurse is reminded with the entry fields, of all data that are desired in the documentation. The nurse is also forced to gather and record important data in the compulsory fields. This results in electronic form of data that enable electronic processing.

Additional fields for entering comments and data that were not envisaged in the original structure are also important. These fields serve in the prototype solution also as information for further development – which data must be additionally structured for electronic processing.

For ease of overview, we have grouped similar data according to their semantic relations. Table 2 shows a tree structure of data for describing a patient, and Table 3 the structure of data for describing a family.

Table 2: Tree structure of data groups on a patient

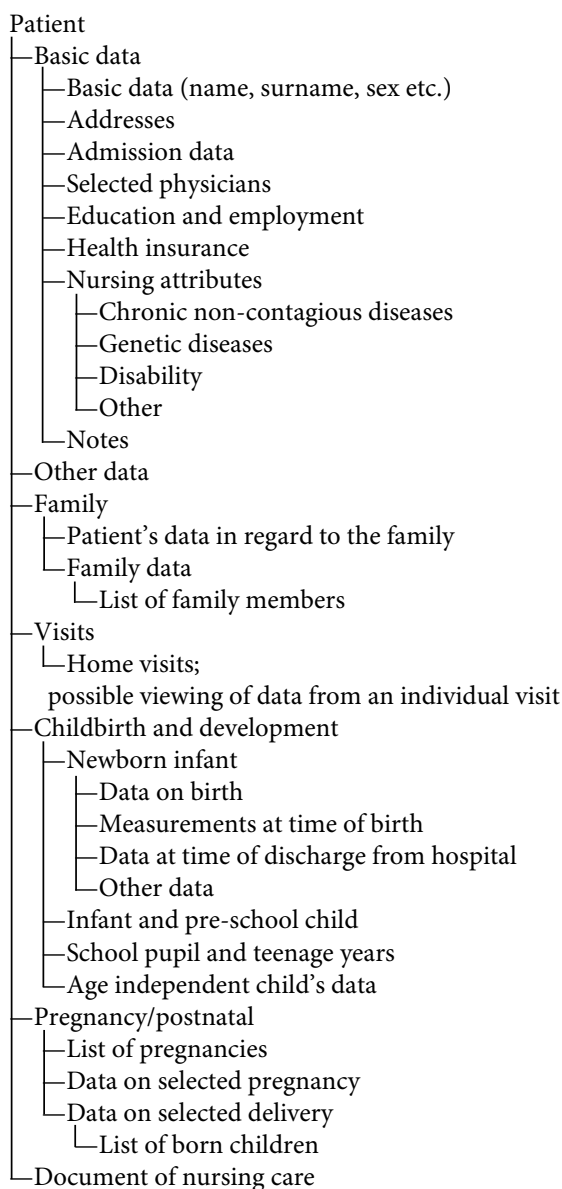
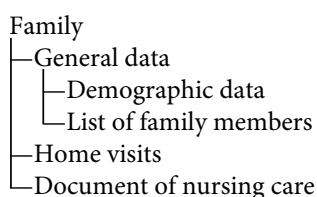


Table 3: Tree structure of data groups on a family



A relational database suitable for storing data in electronic form was developed. It enables simple entry of data, reduces duplication of data and provides fast extraction (Madsen, 2005). The entity-relationship diagram of the proposed database is shown in Figure 2.

It is worth highlighting some particularities in the database diagram. The nursing diagnosis is directly bound

to the subject of nursing. In the nursing diagnosis we record to which basic living activity it is bound, and we are aware that after the evaluation of the nursing care plan, it may remain in the care plane throughout one or more of the following visits.

The subject of nursing can be a patient or a family. In the case of a visit to a family or a visit to a patient living with other family members, we also see a list of all family members who live together. From this list, we can access data on an individual member or on the whole family.

We see elements of the diagnostic therapeutic programme as a list of previously determined nursing interventions, which must be carried out independently in relation to the established nursing problems, nursing diagnoses or nursing goals.

In electronic documentation a user uses a password protected log-in. While it was necessary to sign some of documents in paper form, in electronic version data on the user are automatically recorded. For example, when the user records that an individual nursing intervention has been carried out, it is automatically recorded who entered the data for the individual activity and when.

## 5 Software solution

The steps that comprise the desired course of work of the community nurse (CN) required for each home visit are in accordance with the process method of work in nursing. When the CN selects a patient or a family and one of the planned home visits, a screen picture is shown for the individual home visit. In the upper part are shown data on the selected patient or family, and below the individual steps of the nursing process supported through four tabs: nursing anamnesis, assessment of patient's/family's need, planning and implementation. We will describe later how the evaluation phase is supported.

We have grouped criteria for an overall assessment of patient's need in a tree structure based on the fourteen basic living activities (Henderson, 1997; Bohanec et al., 2000; Šušteršič et al., 2003). It is a professionally accepted and well-known division as it has been confirmed in our survey. A list of parameters opens for each basic living activity of which we wish to remind the CN for gathering relevant data. These parameters are taken from the profession, and in nomenclature we followed the Slovenian translation of the International Classification of Nursing Practice (Cibic et al., 2000).

With each parameter there is a field with free text for the entry of values, e.g., with the parameter of excessive body weight we can insert the body mass index. In addition, with each parameter we can also determine the degree of a problem according to a five-point scale (no problem, minor problem, medium problem, major problem, very severe problem).

The CN chooses the values in relation to the assessed state with individual nursing subjects. From the values describing degrees of problems for parameters under the same basic living activity, the degree of problem for an individual basic living activity is calculated. These calculated values are then shown in the phase of planning. We will later show how we have supported evaluation with these grades.

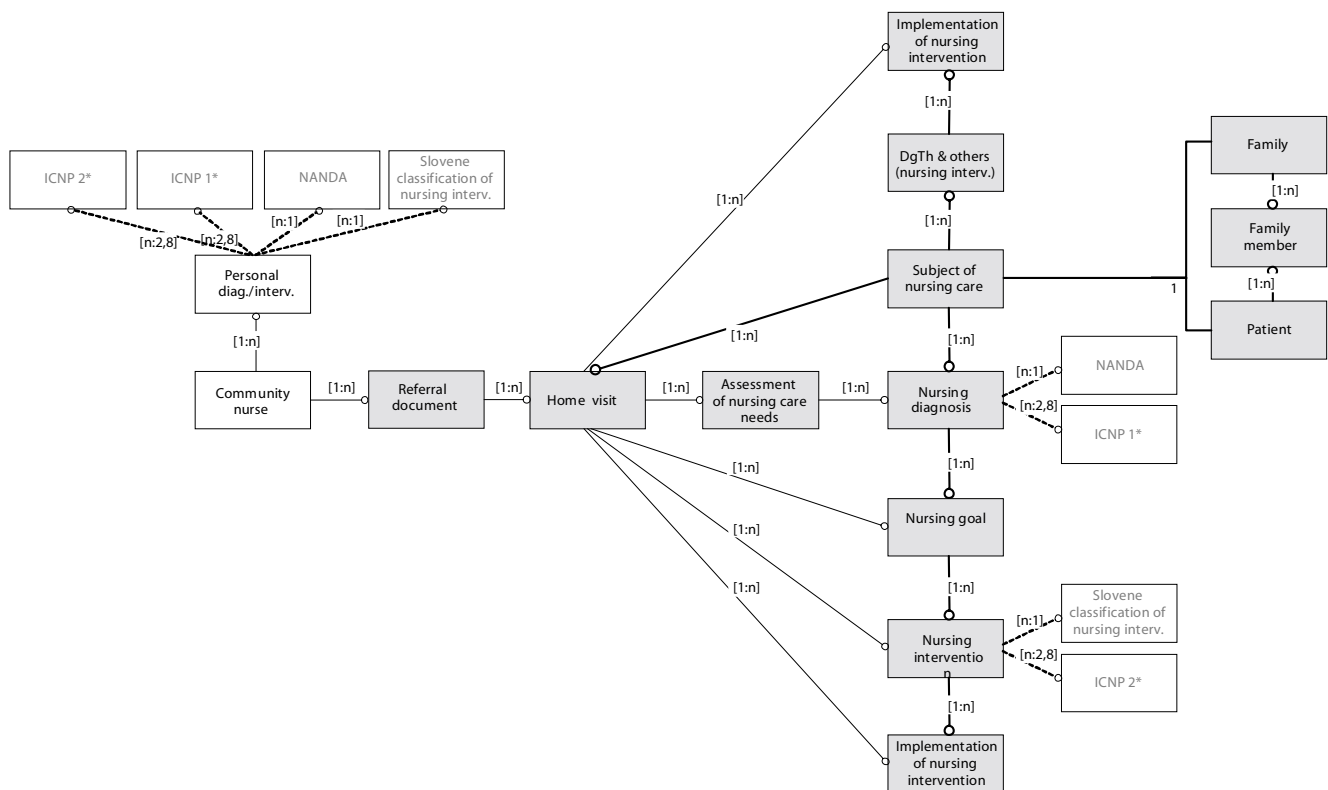
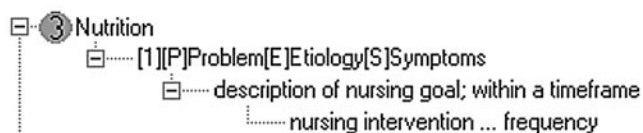


Figure 2: Entity-relationship diagram of the proposed database

Thus, e.g., the value of the parameter appetite has an impact on diet, this on the basic living activity diet and drinking which in return affects the physical basic living activity and, consequently, the overall assessment of the patient. Values of the higher level parameters on the tree structure of parameters are calculated. The CN records values only for final parameters in the tree structure that is parameters on the tree leaves. After a simple calculation, we then obtain the grade of nursing problem for, e.g., an

individual basic living activity, or total overall assessment.

Under the tab planning we compose a nursing care plan in a tree structure. At the first level we see a list of basic living activities and with each a calculated degree of a problem. On the second level we can add to each basic living activity an arbitrary number of nursing diagnoses. To each nursing diagnosis we must further add at least one nursing goal, and to each nursing goal at least one nursing intervention (Figure 3).



- Degree of a problem, basic living activity
- Nursing diagnosis
- Nursing goal; with timeframe
- Nursing intervention ... frequency

Figure 3: Schematic presentation of nursing care plan in tree structure with explanation of individual levels

The nursing diagnosis is made according to the PES system (Problem, Etiology, Symptoms). In denoting a problem, the nurse can get help from the International Classification of Nursing Practice (ICNP beta 2) or the classification of the North American Nursing Diagnosis Association (NANDA) (Gordon, 1994; International Council of Nurses, 1999; Šušteršič et al., 1999; Rajkovič et al., 2003).

Nursing interventions are described by name and frequency of performing them. Nurses denote interventions with the aid of the Slovenian classification of nursing interventions and the ICNP beta 2.

The nurse can store the most often used nursing diagnoses and interventions in her personal directory. In the prototype this is a planned solution, which can be simply supplemented with the catalogues that International Council of Nurses propagates as lists of the most often used nursing diagnoses and interventions for individual fields of nursing.

Under the implementation tab are shown all planned nursing interventions, those carried out need only to be marked.

For the needs of evaluation, we can record comments

on individual nursing interventions, e.g., ongoing evaluation or values of measurements, materials and time used.

After carrying out nursing interventions it is necessary to reassess the condition at the end of the visits. Assessments of the condition between two visits can also be compared. The evaluation phase is supported with the following visualisation elements: comparison of overall assessments that shows progress for every parameter, a progress graph for a selected parameter throughout all previous visits. CN uses these measurements of changes in patient's needs to evaluate nursing goals and other elements in the nursing care plan.

When comparing assessments, we can compare the grade of nursing problem for the recorded and calculated criteria for two entries of overall assessments. We can thus compare two home visits, analyse the condition in the time between visits, or compare the overall assessment before and after visits are made, and analyse the impact of the intervention carried out on the change of condition.

Where we have a number of assessments, it is also possible to show a time series of levels of nursing problem for an individual parameter – what sort of level of nursing problem was shown through all assessments of the condition e.g., appetite.

With these elements we wish to support the evaluation phase. The result of the evaluation phase is reflected in the changed nursing care plan. This means in practice to seek inappropriate elements in the nursing care plan, supplement them, exchange or remove them, and plan a new part of the nursing care plan for the new focus of problems.

The tabs are similar for home visits to the family, differing only in the parameters by which we describe the overall assessment. Instead of basic living activities, we divided the parameters of families into the following groups: socio-economic state, health anamnesis, relations within the family and with the wider environment and functions of the family.

Computer support is provided by a completed prototype software solution. The solution used is a type of client-server and enables the use of laptop computers, which the CN can use directly in the field.

The software is accompanied by a user's manual. It contains instructions for installing the programme and organisational and informational instructions for the direct use of the prototype software. It is basically intended as an aid to the work of the CN in using the software.

## 6 Testing the model in practice

We wanted to check the following categories in testing the proposed solutions:

- Success in implementing the nursing process in accordance with individual phases,
- Strengths and weaknesses of the use of hierarchical models of basic living activities in the process,
- Suitability of the structure of data in nursing documents with an emphasis on the nursing care plan,
- Accordance of the data model and links among data with the current method of work or existing documentation,
- Interface with other processes.

In the alpha phase of testing, after completing the writing of the manual, we checked the operation of the programme in compliance with the manual using simulation of real data. This was first carried out by the programmer and then by two working groups.

Beta testing of the software took place in the community nursing units of Ajdovščina Health Centre and Ljubljana-Bežigrad Health Centre. At both locations we placed software of a client-server type. Each participant in the testing, a CN, thus had available her own computer supported worksite. Data inserted at locations was gathered on the server.

We began with an introductory seminar at each location, which covered:

- Presentation of the programme in accordance with the process method of work,
- Presentation of the manual and annex and
- Test entry of data.

The CNs then had a month to become familiar with the programme and to try some test entries. During this time we solved some open questions in relation to terminology, the new model and software solution.

In order for the CN to become accustomed to work with the programme, during the month they entered test data daily (1-2 entries daily). This was the introductory period, which was intended to make a significant contribution to CNs being subsequently able to carry out the extensive plan of testing.

As a last step, we presented a detailed plan of testing. More than 80 entries in the period of one month provide the framework for testing various subjects with various needs and difficulty of work.

At a new meeting, we then discussed possible difficulties and proposals of improvements and examined the entered records.

A SWOT analysis was carried out, which we performed with the help of the participants of testing at a final meeting.

Strengths (advantages):

- Providing users with integral nursing of high quality;
- Timely recognition of some dangers that threaten the patient;
- Systemically arranged data of a relatively large quantity, which provides an easily viewed information picture;
- Encouragement to the CNs own professional development.

Weaknesses:

- Insufficient ICT equipment;
- In dealing with patients with existing solutions we do not cover some administrative needs (e.g. reading health insurance cards);
- Too many patients per day prevent concurrent insertion of data into the computer (work norms are frequently exceeded);
- Lack of professional knowledge;
- The question is raised as to whether we know and can suitably use the available data.

## Opportunities:

- To be more attuned to the user by means of the available data and be able to offer a higher quality of nursing;
- Users can be better informed and educated;
- Timely recognition of conditions;
- Production of guidelines for professional treatment and higher quality services for users;
- Including family and others in the nursing process;
- Motivation of staff.

## Threats (dangers):

- Insufficient ICT equipment of community nursing services could hold back the use of the system;
- Lack of permanent professional training and willingness of nurses to change could negatively affect on the use of such system;
- Changes in existing methods of work often trigger resistance in staff;
- Commitment to the computer rather than the patient.

Although the model and its prototype are already suitable for use in practice, we will continue to take certain comments into account and make the necessary changes. Extended testing will follow, which means monitoring use of the model in practice in a larger number of community nursing institutions throughout longer period of time.

## 7 Conclusion

The presented model of e-documentation covers the treatment of patients and families both from the aspects of processes and data. On this basis, a prototype organisational and informational solution of nursing documentation for the community nursing segment was developed and has been tested in practice and critically evaluated.

The added value that contemporary ICT can contribute to nursing was presented, deriving primarily from a structured information picture, which monitors the patient and the nurse in the nursing process. It is worth highlighting in particular the use of hierarchical models in the treatment of basic living activities. The model of calculating the grade of nursing problem, which the computer carries out concurrently in relation to the condition of the patient, thus enables an integral overview of the patient and systemically links apparently separate problems. It is thus a direct contribution to reducing the possibility of overlooking something important. E-documentation relies on the nursing record of the patient as a part of the overall health record of the patient (Hammer et al., 2003). This way we avoid duplication of data and the associated excessive work and obtain an overall information picture, which significantly contributes to greater security for the patient and members of the nursing team.

We will continue the work not merely by extending testing and analysis of this model, but also by developing a similar model for documenting nursing in hospitals and dispensaries.

## Acknowledgements

The authors thank the Ministry of Health of the Republic of Slovenia for financing the research work. We are also sincerely grateful to all institutions and individuals who took part in the project.

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