

FEATURE

ARTICLE

Representing the Nursing Process With Nursing Terminologies in Electronic Medical Record Systems

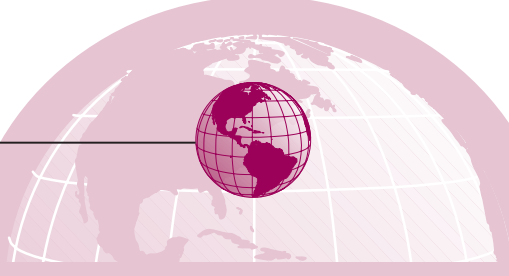
A Swiss Approach

ALEXANDRA BERNHART-JUST,
Diplom-Pflegewirtin (FH)
BRITTA LASSEN, CNS
RENÉ SCHWENDIMANN, PhD

Worldwide, in healthcare systems, and particularly in hospitals, information technologies enable their users to monitor, control, and manage complex processes of patient care. Over the last two decades, medical information systems have become ubiquitous.^{1–3} Now, as a logical step in a process of continuous development, nurses with advanced education in nursing informatics have begun to integrate the nursing care process, with its phases of assessment, diagnosis, intervention, and evaluation of outcomes, into electronic patient record systems.^{4–10}

To document nursing care, several countries already use standardized terminologies.^{11,12} The development of such terminologies, that is, of uniform classification of the components of nursing diagnoses, interventions, and outcomes, represents a key factor for the effective use of clinical information systems that include electronic patient records.¹³ Standardized terminologies specify, define, and provide access to relevant information sets, which represent the state-of-the-art knowledge of nursing care.¹⁴ Their application in daily clinical practice is of particular significance to communication between and within the various groups of involved healthcare professionals, beginning with, but not limited to, nurses and physicians.¹⁵

In 2004, the Nursing Service Commission of the Canton of Zurich, Switzerland's Department of Health, took preliminary steps toward integrating the nursing care



This article describes a framework model within a selected nursing classification system for the integration of nursing care processes into a clinical information system. The “Electronic Nursing Process Data Model,” project was carried out from July 2004 to October 2006 in the Canton of Zurich in Switzerland. The Zurich Electronic Nursing Process Data Model integrates the nursing diagnosis, outcomes, and intervention terminologies in a standardized manner into the nursing care process within the electronic patient record. Findings of the pretest application in clinical nursing practices revealed that (1) functionalities are logically structured, (2) it is difficult to overview many details of the documentation, (3) a specific “to-do list” retrieved from the electronic system is needed, and (4) free-text entries are important to add description of the patient's situation. Furthermore, a consistent assessment terminology needs to be linked to the nursing diagnosis, outcomes, and intervention terminologies and the descriptions of nursing care process within the Electronic Nursing Process Data Model. As the project team, we recommend to implement the developed Electronic Nursing Process Data Model into professional software of clinical information systems and gradually into clinical practice. Therefore, an appropriate utilization strategy includes issues to improve nurses' understanding of the nursing care process and critical-thinking skills: not even the most comprehensive software program can substitute for facilitation.

KEY WORDS

Clinical information system •
Electronic nursing data model •
Electronic patient record • Nursing terminologies • NNN

Author Affiliations: Center for Nursing Research and Development, University Hospital Zurich, (Mrs Bernhart-Just); Spital und Gesundheitszentrum Sanitas, Kilchberg (Ms Lassen); and Stadtpital Waid Zurich and Institute of Nursing Science, University of Basel, Basel (Dr Schwendimann), Switzerland.

Diplom-Pflegewirtin (FH) is German equivalent of a master's degree in nursing science from a university of applied science.

Corresponding author: Alexandra Bernhart-Just, Diplom-Pflegewirtin (FH), Center for Nursing Research and Development, University Hospital Zurich, B SON 6, Rämistrasse 100, CH-8091 Zurich, Switzerland (alexandra.bernhart-just@usz.ch).

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process and the existing Nursing Performance Recording system into its state hospitals' evolving electronic patient records. To design a framework model, it launched the "Electronic Nursing Process Data Model" (ENPDM), a project using selected nursing classification systems with the aim of integrating the nursing care process into the electronic patient records of a clinical information system. The purpose of this article was to describe a framework model within a selected nursing classification system for the integration of nursing care processes into a clinical information system.

WORK OF THE PROJECT GROUP

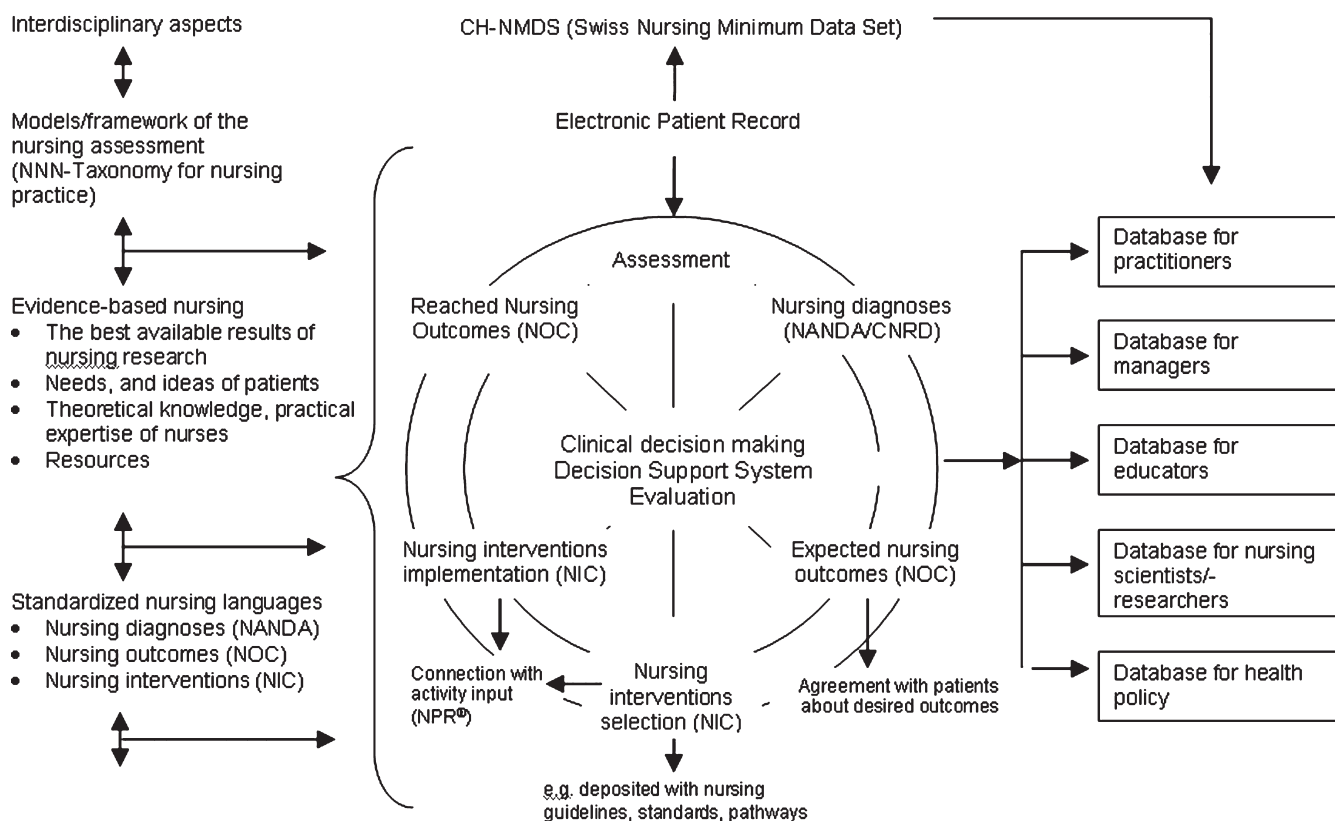
The ENPDM project was carried out between July 2004 and October 2006. The development leading to the ENPDM framework is described in detail elsewhere¹⁶ and is therefore presented only in brief here. The project team, consisting of nursing scientists (n = 5), clinical nursing specialists (n = 7), and computer specialists (n = 2) from 14 hospitals conducted the following working phases.

1. Integrating the steps of the nursing care process¹⁷⁻¹⁹ into the clinical context and selecting the following existing nursing classification systems²⁰ to construct

the ENPDM framework: the NANDA International (Philadelphia, PA); the nursing diagnoses of the Center of Nursing Research and Development (CNRD) (University Hospital Zurich, Switzerland); and the University of Iowa's Center for Nursing Classification and Clinical Effectiveness (Iowa City, IA) NOC and NIC.

The basis for the development of the ENPDM was the Nurse Terminology Model, originally developed by Hughes and the North Wales Nursing Terminology Group,²¹⁻²³ as well as experiences arising from the HANDS Project⁸ (Figure 1).

2. Linking and compiling each phase of the nursing care process using the components of the nursing diagnoses (NANDA, CNRD), nursing outcomes (NOC), and nursing interventions and activities (NIC) terminologies²⁴ as a data model and the integration of that model into an electronic application (Microsoft Access 2003; Microsoft, Redmond, WA). Now, the ENPDM was available as an electronic patient record with testable functionalities for application in clinical practice.
3. Step-by-step testing and revision of the ENPDM data model, applying four fully programmed relevant NANDA nursing diagnoses: "self-care deficit: feeding, toileting, bathing/hygiene, dressing/grooming"; "anxiety";



© North Wales Nursing Terminology Group from an original idea by Dr. Rodney Hughes [21, 22, 23] modified by Just²⁰

FIGURE 1. Framework of the ENPDM. Reproduced with permission of Blackwell Publishing.

“acute pain”; and “impaired mobility”²⁵ along with its associated nursing outcomes (NOC)²⁶ and interventions (NIC).²⁷ To integrate the data model into an electronic application, it was configured as a relational database (MS Access 2003). Between October 2005 and May 2006, a total of four test runs of the ENPDM took place in each of the 14 participating hospitals. This third step included the following: (1) The project team reviewed whether the data model corresponded with the internal structure of the patient records in the different clinical settings; and (2) using a catalog of evaluation criteria, staff nurses from the 14 hospitals checked the functionality of the data model in the daily nursing care process documentation with regard to a real patient situation.

4. The project team revised and adopted the data model according to the nurses’ evaluation criteria-based feedback and the team’s review leading to the final ENPDM.

FINDINGS

The Zurich ENPDM has now integrated the NNN terminologies (NANDA, NOC, and NIC) into the elec-

tronic patient record to follow the flow of defined phases of the nursing care process in a logical sequence²⁰ (Figure 2).

Based on the clinical information input, the electronic patient record software automatically suggests suitable concepts and terminology from its database, along with corresponding nursing care processes or actions, and guides the nurses through the necessary steps for clinical decision making. Open text fields are available for additional entries in every phase of the nursing care process. Such entries are summarized in a background course report.

The labels of the NNN terminologies are placed within the text in the form of structural headings. Therefore, the nurses can easily enter or search for comments within the course report. Moreover, with a filter function, it is possible to extract information ranging from individual comments to all topics. The primary course report bidirectionally connects nursing diagnoses, nursing outcomes, and interventions (including their individual activities) and the relevant comment fields. This enables the nurses to have two points of access to read and write comments and entries in the electronic patient record. For each sequence of nursing diagnosis, intervention, and

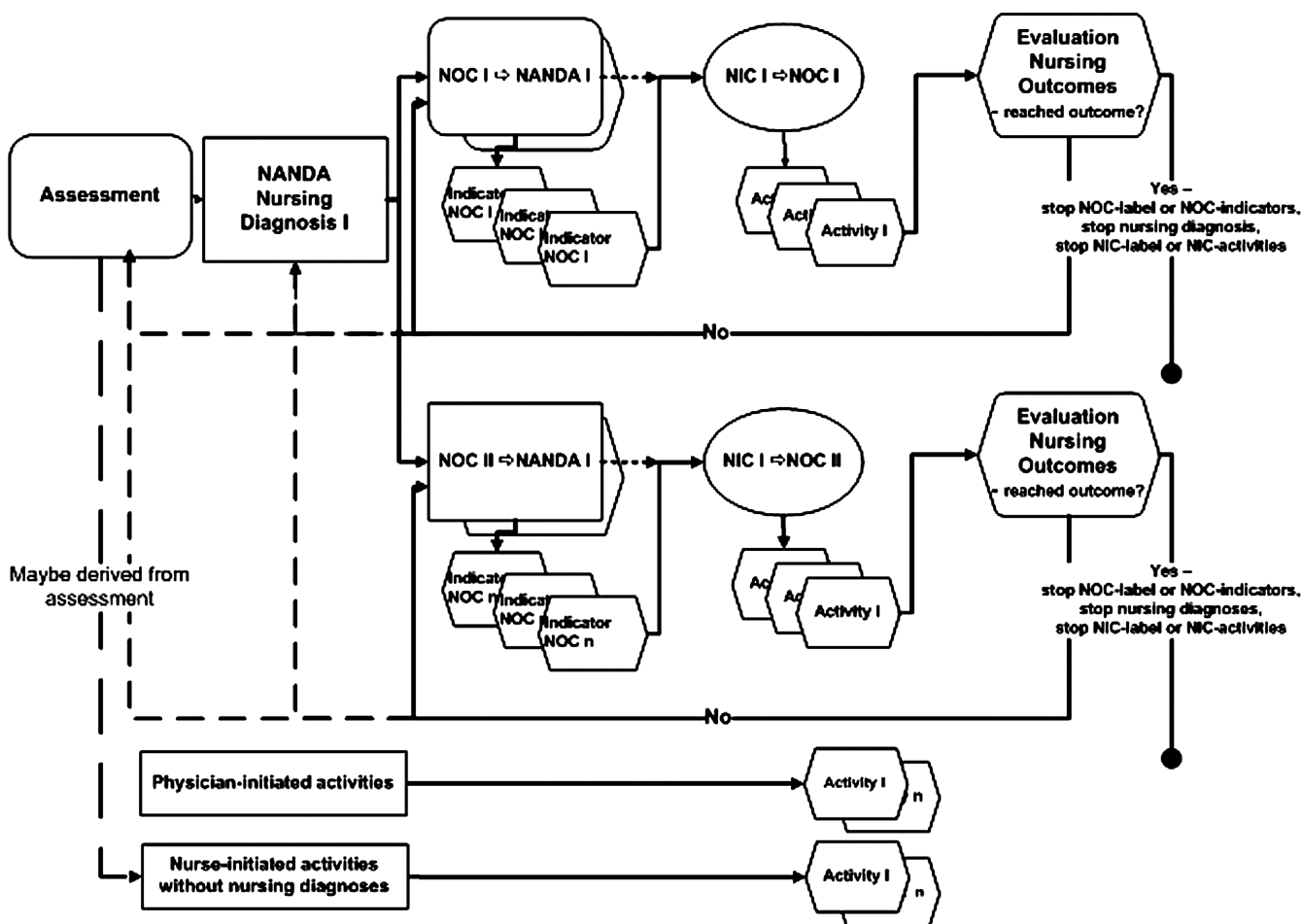


FIGURE 2. Process flows in the Zurich ENPDM.

outcome, the respective definition is accessible in the electronic patient record.

In the following sections, the resulting ENPDM is described using the six phases of the nursing care process, including an explanation of the interfaces between the NNN terminologies.

Initial Patient Assessment and Its Documentation

Since no systematic, standardized assessment strategy compatible with NNN terminologies and the Zurich ENPDM is available, requirements can be outlined as follows. Information at different levels are needed to illustrate the assessment phase within the electronic patient record. At the primary level, taxonomy of clinical care types and processes must serve for the initial patient assessment. This will then facilitate the start of the nursing care process, based on the domains and categories of the common NNN Taxonomy of Nursing Practice.²⁸ Subsequently, questions to categorize the health status of the patient will assist nurses in developing a focused assessment, which will lead to a well-informed nursing diagnosis.

The focusing assessment dialogs contain questions, instruments, or scales specifically to assess the health problems and nursing care needs of the patient. With its signs-symptoms-etiology structure, the recorded assessment data can be assigned to appropriate items such as those used to formulate nursing diagnoses. The nurses then have to validate their diagnosis clinically with the patient or his/her proxy and prioritize according to the clinical situation.²⁹

Establishing and Documenting the Nursing Diagnosis

When confirming the nursing diagnosis suggested by the system, the assessment data are assimilated and added to the nursing diagnosis, after which the relevant terminology is automatically integrated into the corresponding data fields.

The nurses who tested the ENPDM were able to collect all the required patient-related data to document the nursing diagnoses. Because some nursing diagnoses could apply to relatives of the patients, that is, could be subject to a "knowledge deficit,"²⁵ some of the nurses asked for a box in the ENPDM to name the bearer of the nursing diagnosis.

The Observation of Desired Care Results

Based on the nursing diagnosis, the system lists associated outcomes (NOC) as well as a set of result in-

dicators to be assessed on a Likert scale. Furthermore, a time is specified by which the debit value (the desired result state) should be reached. From the assessment to the end of treatment, each recorded value will serve as a reference for further measurement regarding the results of nursing interventions.

The documentation of the nursing outcomes with the NOC terminology was the step that required the most significant shift in the nurses' way of thinking. Few of the nurses were familiar with the vocabulary of the nursing outcome language (NOC).

Documentation of Planned Care Interventions

With reference to documented nursing outcomes, intervention options are suggested by the system. Once one is selected, individually defined nursing activities are assigned. Additionally, the software uses selected means to suggest the level of competence necessary to carry out a nursing activity. The individual nursing activities are converted into a work schedule in which all nursing interventions, whether diagnosis related or diagnosis independent, are represented. So that the nurse can take into account resources and preferences of a patient during interventions, they are explicitly stated on this schedule.

For timing and carrying out the nursing interventions for a patient, nurses have to choose a date and time. To facilitate this step, they stated that they would like to have a calendar in the electronic nursing intervention area. Moreover, they would like to receive a printable to-do list of all suggested NIC interventions and NIC activities, including dates and times.

The Documentation of Executed Nursing Interventions

Planned and executed nursing interventions are documented in the system in a manner visually different from those that have been planned but have not yet been executed.

The Evaluation of Nursing Outcomes

Evaluation is an integral component of every phase of the nursing process.³⁰ The individual outcome indicators (actual value) are given using a Likert scale and compared with the debit values of the outcome indicators (NOC). The measurements are represented graphically, including their indicator values at the beginning, current, and debit value including the time, date, and signature of the nurse in charge. The evaluation of the individual phases of the nursing process

allows the formulation of a summarized judgment, according to which the strategy and effectiveness of care planning can be evaluated and adapted. The nurses mentioned that time intervals must be defined for the reassessment of the NOC indicators. They also asked for an automatic electronic request to evaluate the achieved nursing outcomes.

The components of the Zurich ENPDM are summarized in Figure 3.

Interfaces

The use of the ENPDM allows sharing of required data with the Swiss Nursing Minimum Data Set (CH-NMDS). However, in this context, the Swiss Nursing Minimum Data project aims at the mapping of the reference classifications of nursing phenomena and nursing interventions with the NNN terminologies used here.³¹ The interfaces to the CH-NMDS have the option additionally to generate cost carrier invoice data based on the documented nursing interventions.

Based on their experiences regarding the tests, the nurses judged the data fields and processes of the ENPDM to be well structured and logical with the nursing process. The linkages between the nursing diagnoses, nursing outcomes, and nursing interventions appeared to be helpful and time-saving for the nurses.

Additionally, the nurses identified several strengths of the ENPDM: compared with paper-based documentation, the fixed concepts of the NNN classifications could increase the expressiveness of the nursing process documentation; the common use of standardized concepts promotes a common language in clinical nursing and in nursing records; and electronic documentation will reduce the paperwork and lead to the end of “tiring” consideration of free-text formulations.

The nurses also expressed a critical attitude regarding certain points, for example, the high level of detail in the documentation. They believed this would give them too much to read, while raising the risk of a confusing illustration of the electronic nursing documentation on the display. The numerous conceptual choices could

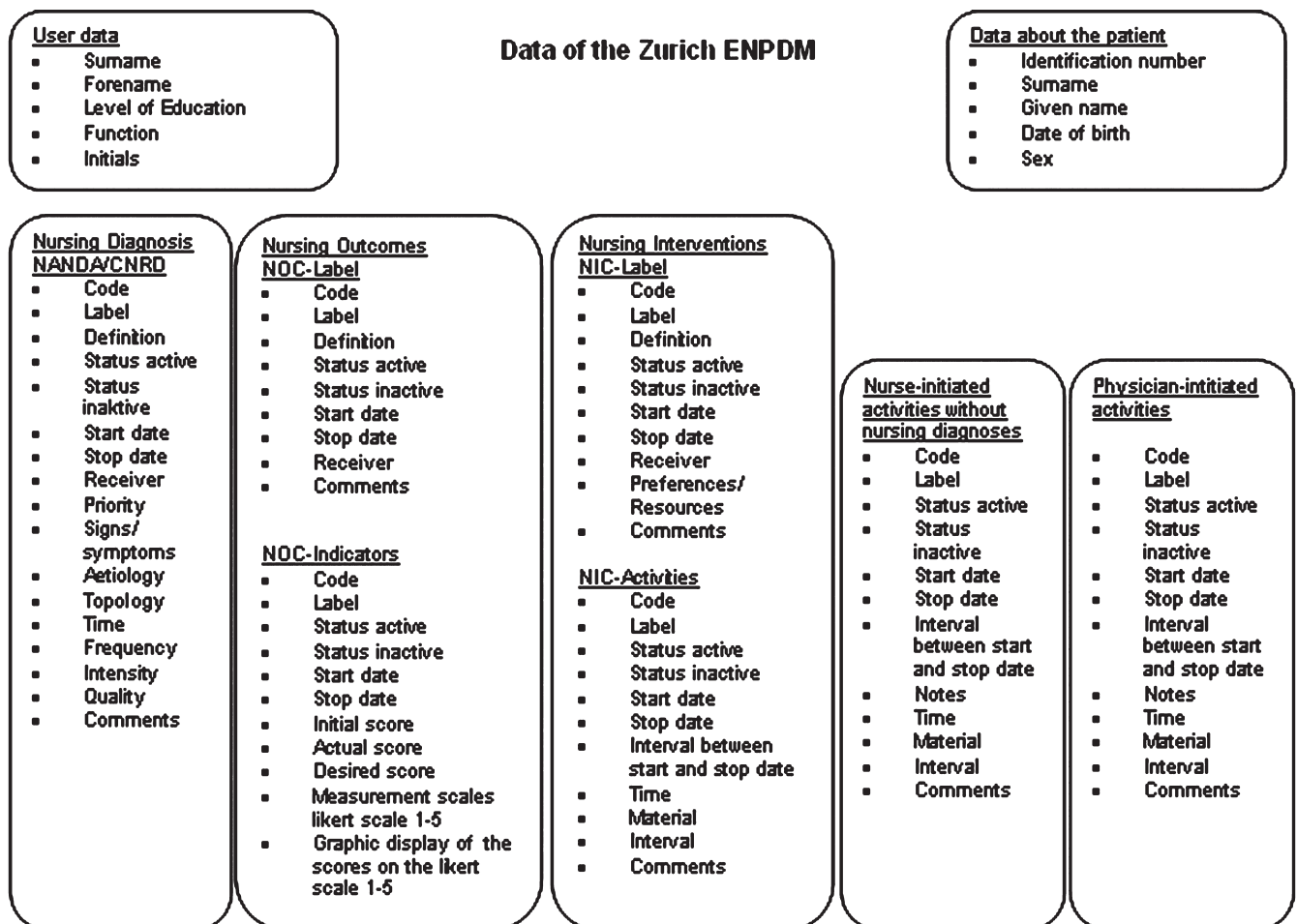


FIGURE 3. The Zurich ENPDM.

make the documentation process complex in everyday practice and would seem strange for nurses not familiar with the concepts of the NNN classification and concept terminology. The nurses realized that they have to adjust themselves from free-text documentation to the pre-defined concepts of the NNN classifications. They also emphasized the possibility to add free-text information where necessary to solidify the NNN classification concepts. Finally, they considered a well-designed training course to be necessary for the users because most nurses would have insufficient knowledge regarding the NNN classifications and their underlying concepts.

The following section discusses conclusively relevant aspects of the testing phase of the ENPDM.

DISCUSSION AND CONCLUSIONS

According to Johnson et al,³² standardized technical language and database development are prerequisites for the development of health services by nurses. The Zurich ENPDM may satisfy this prerequisite because it integrates the NNN terminologies in a systematic and standardized manner into the nursing care process within the electronic patient record. In addition to this result of testing the ENPDM, we acknowledged important requirements related to designing an electronic nursing record, the implementation of the NNN terminologies in an electronic nursing record, and nursing education.

Designing an Electronic Nursing Record Based on NNN Terminologies

An electronic patient record should be constructed logically and have a working interface that not only supports clinical decision making but also offers intuitive use by nurses in their everyday practice.³³⁻³⁶ The functionalities of ENPDM with its nursing record appeared logically structured, as was confirmed by the nurses.

Although the computer-based ENPDM piloted the nurses systematically through all phases of the nursing process, the amount of collected data mushroomed, leading to dense and complex documentation.⁶ This raised objections from the nurses about the transparency and clarity of the interface's nursing documentation. With so many details crowding the display, it was difficult for nurses to develop and maintain an overview of the nursing process documentation. This requires cooperation between system designers and implementers to find solutions suitable for clinical practice and also visually attractive and supportive in daily use.³

In addition, the interfaces themselves should be considered, for example, how interdisciplinary aspects such as those of medical and nursing assessments, or even an

actual interdisciplinary assessment, could be facilitated electronically. For the purpose of improved interdisciplinary cooperation, additional questions arise about access codes on electronic nursing records or the connection between the nursing diagnosis and the medical *International Classification of Diseases* diagnoses or diagnosis-related groups. Adding nursing diagnoses to medical diagnostic data is important: Diagnosis-related groups and nursing diagnoses were significantly associated with hospital outcome variables.^{37,38}

What the nurses in our test reported missing the most was the opportunity to generate a working list or a to-do list, specifying all the NIC interventions and NIC activities they should carry out, from the electronic system.

Inclusion of Software Vendors

With projects such as the one described here, thoughts should be given to the option of including specialists and developers of software programs regarding the conceptual, nursing-specific preliminary work of designing electronic nursing process documentations. An early cooperation with software vendors in such developmental processes can ensure that the provider of such programs consider and incorporate not only the demands of nursing managers and nurses working in clinics, but also the requirements from the perspective of nursing science and research. In addition, automation of the nursing process should go along with and be integrated in the automation of activities of all other professions in healthcare (medicine, physiotherapy, etc) and complement them.³⁹

When this project was started, all involved hospitals were working together with different software producers. Because of this fact, a cooperation with software providers was not up for discussion. The project team wanted to deal with this task without being influenced or affected by technical possibilities and limitations. In addition, the team wished to avoid favoring one software provider over others, and the project team became too large.

Requirements for the Implementation of the NNN Classifications in an Electronic Nursing Record

The test of the ENPDM showed us that further development is necessary of the documentation of the assessment phase within the electronic patient record. Despite that the assessment component is only outlined here, it is crucial to nursing diagnosis and all subsequent steps within the nursing care process.¹⁷⁻¹⁹ Therefore, it is urgently necessary to develop assessment strategies and instruments

to examine and integrate them, in conjunction with nursing diagnosis, into the electronic patient record.

With reference to the numerous choices of concepts that nurses could choose from the NNN terminologies, the test made it clear that the NNN terminologies must be filtered according to clinically relevant links and specialist aspects such as use for specific patient groups or specialty clinics such as maternity or care of older people. Otherwise, the NNN terminologies will not be feasible for the nurses in their clinical settings.¹⁰ Another challenge for nursing scientists and researchers is to build up the links between NANDA, NOC, and NIC on an evidence-based level. This is also important for the integration of assessment instruments and the overall lexicon of the standardized nursing terminologies.^{9,40–42}

In our tests, the nurses stated that, in some cases, the NNN concepts were not sufficiently concrete to describe the patient situation appropriately. In the ENPDM, free-text entries are available through every phase of the nursing care process, and nurses judge these opportunities as important. To allow inclusion of all relevant details, free-text entries are considered necessary.^{43,44}

Because a detailed documentation will generate considerable data, it should be discussed with nursing practitioners, managers, and scientists, and so on, for which purpose which and how much nursing data will be necessary in the future. A challenge will be not only to collect and store data but also to automatically analyze the data and extract meaningful information from it for different groups of interests.⁴⁵

After testing the ENPDM, we recommended that the Nursing Service Commission of the Canton of Zurich implement the developed Electronic Nursing Process Data Model into professional software of clinical information systems and gradually into clinical practice. Therefore, an appropriate utilization strategy includes issues to improve nurses' understanding of the nursing care process and critical-thinking skills because not even the most comprehensive software program can substitute for facilitation.

Nursing Education

Since many nurses in Switzerland have limited knowledge regarding the NNN classifications and their associated concepts, the involved nurses consider the need for an effective training course. Today in Switzerland, the most popular terminology is NANDA.

Regarding the nursing care process, continuing education for nurses is necessary because no software program can substitute for a deep understanding of the nursing care process and its essential components. Therefore, the introduction of the NNN terminologies alone cannot be expected to bring about significant improvements in care quality.⁴⁶ Although the Zurich ENPDM may support con-

ceptual understanding of the nursing care process, it is of paramount importance to further promote critical-thinking skills and their translation into clinical practices. The rearrangement of the previous hard copy-based patient records into a standardized electronic patient record will remain a great challenge for many nurses for some time.^{47,48} The nurses have to fully understand the concepts of the NNN terminologies⁷ and how they use them. Moreover, to grant sustainability, the project's managers must support and facilitate the nursing staff to ensure adoption of the new system into their daily practice.

For a meaningful use of standardized nursing terminology, particularly the development and effective use of electronic nursing process documentation, nurses will obviously continue to play a key role.⁴⁹ To face this challenging issue, though, more nurses must achieve profound competencies in the field of nursing informatics. Nursing informatics is very important for the nursing profession: it combines information, nursing, and computer science to communicate and manage information and data to support decision making for healthcare providers and nurses alike.⁵⁰ Accordingly, nursing educators and health institutions (hospitals, community nursing homes, etc) have the responsibility to provide education at professional levels including BSN and MSN on this subject and include it in their curricula and practice.^{1,49,51,52} For Switzerland, this is especially important since no specific undergraduate or graduate nursing informatics education programs currently exist.

Considering the increasing use of information technologies in the development of composite knowledge, hospitals will soon demand correspondingly extensive and user-tailored computer knowledge within the field of professional nursing practice. With this report, based on the nursing care process in Switzerland, the project team hopes to stimulate professional discourse regarding electronic patient records.

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