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Nursing Documentation in the Computer-Based Patient Record

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This paper describes the INFORMM NIS (Information Network for On-line Retrieval & Medical Management Nursing Information System) charting system developed by the Departments of Nursing and Information Systems at the University of Iowa Hospitals and Clinics (UIHC). The documentation system features automated work lists, defaulted charting responses, decision support, automatic computations, chart forms and reports, and graphical displays of clinical data. The impact of the on-line charting system has been demonstrated by content standardization with Nursing Interventions Classification (NIC), improved standards compliance, increased efficiency, enhanced timeliness, expanded accessibility, and an augmented data archive.

Introduction

According to the literature, automation of on-line documentation provides improvements in charting: accuracy, legibility, completeness, timeliness, decision support, and quality. Manual and automated charting have been compared in terms of nursing time and time spent in nurse-patient contact. Authors variously report that on-line charting decreases, increases, and does not affect time spent in documentation activities or time spent in nurse-patient contact. [1,2,3,4,5,6].

Background

The UIHC took a major step towards achieving a Computer-based Patient Record (CPR) by implementing a comprehensive on-line charting system for patient care orders in 1994. Developed as part of the *INFORMM NIS*, the charting system features efficiencies in documentation as well as computer-generated chart forms and graphical displays of patient data.

At UIHC, on-line nursing documentation has now replaced manual charting. Nurses, physicians, and other health care providers now use a computer terminal to review profiles of patient data instead of chasing paper records or seeking individual medical, nursing, or support staff. The charted data are available on-line and are accessible to authorized individuals from anywhere in the clinical enterprise.

Environment

The University of Iowa Hospitals and Clinics

The University of Iowa Hospitals and Clinics (UIHC) is an 831-bed tertiary-care teaching hospital providing service to approximately 35,000 inpatients and 483,300 ambulatory care patients annually. More than 2,500 patients are treated daily, supported by a staff of 7,460.

INFORMM Hospital Information System

INFORMM provides 176 unique applications on an IBM 9672-R44 with a Multiple Virtual Storage/Enterprise Systems Architecture (MVS/ESA) operating system. Configured in the

network are approximately 1,700 cathode ray tubes (CRTs), 400 personal computers (PCs), and 310 printers. *INFORMM* provides in-house and remote access to more than 8,000 users.

The computer system operates continuously with the exception of an average of 20 minutes weekly. The *INFORMM* System supports 2,575 functions and averages 2.1 million transactions daily while maintaining an average response time of less than 0.2 seconds. The NIS documentation system averages more than 1 million transactions weekly.

INFORMM Nursing Information System(NIS)
Developed entirely in-house at UIHC, the INFORMM NIS was implemented in 1988. Patient care planning, patient critical data, patient problems/nursing diagnoses, nursing interventions, patient outcomes, patient care orders, and patient discharge referral data are entered, updated, and documented on-line [7,8,9]. Developed and maintained by nursing personnel, the INFORMM NIS database contains the Nursing Interventions Classification (NIC) and will be enhanced to include the Nursing-sensitive Outcomes Classification (NOC) [10,11,12].

System Development
Development of the INFORMM NIS documentation system encompassed the phases of system design, hardware configuration, database preparation, education, implementation, and evaluation.

System Design
The computerized charting system was designed and developed in-house by the Nursing and Information Systems departments. For more than one year, representatives from each clinical nursing specialty met with nursing informatics specialists and systems analysts to design the core charting component of the INFORMM NIS. In addition to identifying objectives, this task force compiled a report of the manual charting system and a detailed logical design document. These documents were reviewed by the appropriate administrative parties in order to address operational and policy issues before programming commenced.

Hardware Configuration
Each patient care unit using the on-line charting system was involved in the decisions concerning the number and placement of additional computer terminals. In most instances, terminals were placed in the patient rooms [13] When Graphical User Interface (GUI) applications were designed and available, personal computers were installed on each patient care unit for clinical data displays.

Database Preparation
In preparing for on-line documentation, the INFORMM NIS database was re-organized and streamlined. Patient care orders were standardized and enhanced with order details (specifics for performing the order) and charting parameters (documentation data elements). Subsequently, order groups were converted to NIC interventions. Through the efforts of standardization, the number of orders was reduced from 3,122 to 302 and the number of order groups from 1,451 to fewer than 500.

Education
User education for order charting consists of two sessions. Users attend a combination session of lecture-discussion describing the concepts of order charting and "hands-on" training using a standardized case study. Additionally, users participate in a practice session with content specific to the users' patient population.

Implementation
After approximately 3,200 programming hours, on-line documentation was piloted on an inpatient care unit in September, 1994. The pilot was extended to representative units from each of the nursing divisions at a rate of one patient care unit approximately every three weeks. Implementation on all general inpatient care units was completed by December, 1996.

Evaluation
The INFORMM NIS documentation system was evaluated on the achievement of specific objectives related to the quality and efficiency of documentation and user response. These objectives are reflected in the features of the on-line system.

Featured Elements of the Documentation System
Among the many system features are automated work lists, defaulted charting responses, decision support, automatic computations, chart forms and reports, and graphical displays of clinical data.

Automated Work Lists
Patient care orders are added to the *INFORMM* NIS. Both on-line and in a printed report, the system presents the care provider with a list of orders to be carried out at scheduled times. To maintain accuracy, the system removes an order from the work list as soon as the activity is charted.

Defaulted Charting Responses
When a nurse charts against an order, the system provides the previously charted results as a default for the current charting event. If the response has not changed from the previous charted entry, the nurse simply accepts the previous entry as valid for this time. Providing the previous response as an option for the current time period expedites charting when a patient's condition has not changed and alerts the nurse to changes since the last charting event.

Decision Support
The orders and valid charting responses are selected from user-defined tables. Using these tables, the system guides the user as to what is appropriate and necessary to chart, and provides valid charting responses. In this way, the system ensures standardized orders and charting responses. The system edits to ensure that responses are valid and that the user is following appropriate protocol. Since the system identifies which parameters should be charted, charting is more complete than with a manual system.

Automatic Computations
The on-line documentation system computes quantitative data entered for orders and assessment tools. When intake and output data are entered, the system tallies sub-totals, totals, and fluid balances for each shift, each day, and by specific intake and output categories, thus creating the "Intake and Output Profile". This profile appears on chart documents and data reports and also can be retrieved on-line. Additionally, scores for assessment tools, such as the Glasgow Coma Score, Falls Risk Assessment Tool, and Braden Scale, are also computed and available for on-line review.

Chart Forms and Reports
The system generates chart forms and data reports on demand at any location by an authorized user. Considerable design effort was devoted to the consolidation of many manual variations into one standard chart form and concise data reports. The chart forms contain

profiled result data followed by order charting and summary notes for a given 24-hour period. The system automatically prints chart forms from the previous day at 3:00 a.m. on the laser printer located at the patient care unit.
The Patient Data Report consists of a patient's data profiles, laboratory and radiology results, and charted data of the previous 16 or 24 hours as requested. The Summary Data report provides summarized vital signs (high and low values and the most recent data), the intake and output profile, and laboratory data for the past 16 or 24 hours for one or more patients. These reports have proven useful to clinicians giving report and for clinical rounds.

Graphical Displays of Clinical Data
Providing profiles on-line is one of the most beneficial aspects of the system. As the UIHC moves away from its dependence on the paper document, health care providers readily retrieve on-line profiles to evaluate patients' conditions. The tremendous value of profiles is based upon their presentation of logical data units abstracted from multiple systems. For example, the blood glucose profile is generated from the laboratory, dietary, and nursing documentation systems . To create ad-hoc profiles for data groupings that are less common, a user selects orders for a time period, and the system profiles the data immediately on-line and in print as requested.

Benefits Achieved
Benefits experienced include content standardization with NIC, improved standards compliance, increased efficiency, enhanced timeliness, expanded accessibility, and an augmented data archive.

Content Standardization
Nursing Interventions Classification (NIC) content replaced the existing INFORMM NIS database content for order groups. NIC contains 433 nursing treatments with an intervention label, a definition, and a list of defining activities. NIC interventions were converted to the INFORMM NIS database and provided users with consistent, standard order groups reflecting current standards of care. Documentation was simplified by the streamlining and enhancement of orders. Since each order includes charting parameters as well as valid responses, documentation data are standardized and complete. In reviewing initial pre- and post-implementation data, the level of charting completeness nearly doubled from the manual to the on-line system.

Improved Standards Compliance
The automated work list of orders sequenced by "due time" reduces the likelihood of an omitted order and supports nursing policy by ensuring certain actions are triggered at the appropriate time and frequency. On the initial pilot unit, for instance, compliance for the documentation standard of assessing and charting the pain ratings every four hours increased by 58% on the first day. In an independent compliance study using over 70 patient records, manual charting scored a 60% compliance rate compared to the 100% compliance rate of on-line documentation.

Increased Efficiency
On-line documentation has increased efficiency by eliminating redundant and repetitive data recording. Manually charted data were documented repeatedly on many chart forms wasting care providers' time and increasing the risk of transcription errors. Through automation, the user records the value once and the value can appear in an unlimited number of profiles and paper documents. Defaulting previous data has eliminated the time-consuming task of re-writing each order and the patient responses for each charting episode. Moreover, the system improved legibility and organization by providing typed documentation in a standard and structured format both on-line and in print.

Enhanced Timeliness
In the manual system, users often charted at the end of shift by remembering data or referring to scratch notes. With on-line charting, the system eases the task of documentation enabling the user to document activity as it is carried out, thereby reducing end-of-shift charting.

Expanded Accessibility
With on-line access, the most current data are available immediately from any device throughout the UIHC or remote sites with proper user access privileges. Moreover, data retrieval is not limited to one person at a time as with the paper record.

Augmented Data Archive
The system provides individual and aggregate data for clinical, administrative, research, and quality improvement purposes. All data are archived and never deleted. Once the data are entered on-line, manual chart reviews are no longer necessary.

Summary

These observed system features and benefits indicate that the on-line charting system has positively affected documentation practices. Indeed, users have expressed strong support for the system. On-line charting has revolutionized documentation at the UIHC both in recording patient responses to orders and in accessing patient data. With this and other applications, the UIHC has established automated systems that make the computer the primary information tool for all aspects of clinical care. Thus, the INFORMM NIS documentation system represents a major milestone towards the achievement of the computer-based patient record.

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